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Interpreting the Plant and Animal Remains from Viking-age Kaupang

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This chapter outlines the results of analyses of the plant remains, insect remains and animal bones recovered from the main research excavation of 2002 at Kaupang (with some comparative treatment of material from the cultural resource management (CRM) excavation in 2000 and the harbour excavation in 2003). Both surface-laid deposits (such as house floors and occupation deposits) and waterlogged pit fills have been examined, but only the latter produced well-preserved material. The survival of animal bone at Kaupang was particularly poor. Despite these limitations, it proved possible to illuminate a number of the Kaupang Project's research questions. The formation of individual features and feature types has been clarified, with pit fills interpreted as redeposited house floor sweepings, for example. The seasonality and permanence of the site has been explored – Kaupang was probably occupied year-round, at least occasionally, but it also produced evidence of either periodic abandonment or a relatively short overall lifespan. It has been possible to demonstrate that the settlement drew on a range of agricultural and forest resources from its local hinterland, implying that it either controlled or was controlled by a regional polity. Conversely, the ecofactual evidence of long-range trade was very limited. There is, however, a slight possibility that skins (furs?) were stored indoors at the site prior to transhipment. Be it evidence of trade connections or culturally prescribed dietary preferences, the ecofactual evidence from Kaupang also showed associations with both the Baltic region to the east and the North Atlantic region to the west.

14.1 Introduction

This chapter surveys the recovery, analysis and interpretation of plant remains, insect remains and animal bones from the main research excavations of 2002 and the harbour excavation of 2003 at Kaupang. Almost all of the material is from Site Periods I–III (SP I-III) and thus dates to the early 9th century (Pilø, this vol. Ch. 9). Most of it, excavated in 2002, is from Plots 1A, 1B, 2A, 2B, 3A and 3B (henceforth referred to as "1A–3B") but small-scale study has also been made of material originally deposited in the settlement's harbour, which was excavated in 2003. Cross-reference will be made to work on plant remains, insect remains and animal bones recovered during cultural resource management (CRM) excavations conducted in 2000 (Hufthammer and Bratbak 2000; Buckland et al. 2001).

The ecofactual material from Kaupang can inform interpretation of the settlement in a variety of ways. It is possible to characterise the nature of specific deposits, such as occupation deposits and pit fills, to shed some light on the seasonality and permanence of the settlement, to evaluate the local economy and the site's articulation with its hinterland, to illuminate the character of long-range trade and to place the occupation of Kaupang within a wider comparative context. The range of interpretations possible is enhanced by the survival of some deposits preserved by anoxic waterlogging, principally pit fills. Unfortunately, however, the breadth and depth of interpretation is also severely limited by the small number of deposits preserved in this way, particularly in comparison with some other Viking-age and later medieval urban sites (e.g. Schia 1988; Kenward and Hall 1995). Moreover, bone preservation at Kaupang is extremely poor. Most of what survives has been burnt and highly fragmented. Were it not for the critical importance of Kaupang to the history of Viking-age Europe, a bone assemblage of this kind might go unanalysed. In sum, analysis of the ecofactual material from Kaupang has presented both opportunities and challenges. The work has sometimes been an

Table 14.1 *Charred plant remains and other components of the light (floating) fractions from 54 selected BS samples. Charcoal abundance: material included A – alder* (Alnus); *C – hazel* (Corylus); *Con – Coniferae; F – ash* (Fraxinus); *Q – oak* (Quercus); *?P – ?rose family, pro parte (Pomoideae); S/P – willow/aspen/poplar* (Salix/ Populus). *Numbers represent the three-point semi-quantitative scale of abundance outlined in the methods section (14.2).*

exercise in wringing limited information from very poorly preserved material. Nevertheless, the overall results have proven informative regarding a number of the Kaupang Project's research questions, and thus worthwhile.

14.2 Methods

The ecofacts considered here were recovered in three main ways (cf. Dobney et al. 1992): as 'bulk sieved' samples, as 'general biological assemblage' samples or as 'site riddled' bone. Sediments from deposits that were not waterlogged, but seemed likely to yield charred botanical material, were typically collected as bulk sieved (BS) samples of c. 10 litres and processed in the field by flotation (in which the heavy fraction was retained by a 1 mm mesh and the floating light fraction by a 0.5 mm mesh). High priority was given to hearths, occupation deposits, dumps and other potentially informative layers. These samples proved to be rather homogeneous and the material they contained was very poorly preserved. Thus only a selection of heavy fractions and light fractions were chosen for post-excavation analysis (see section 14.3 below). Materials from the heavy fraction were quantified by weight and all plant taxa and other components of the light fractions were recorded using a three-point semi-quantitative scale: from 1 (one or a few specimens or fragments) to 3 (abundant, or a major component of the sample).

Waterlogged deposits were typically collected as whole earth general biological assemblage (GBA) samples of c. 10 litres each. Subsamples of these (usually constituting a minimum of 3 kg of sediment) were later sieved to 300 m in the laboratory, with invertebrate macrofossils recovered using procedures broadly following the paraffin (kerosene) flotation method described by Kenward et al. (1980, 1986). A tally of plant remains and other components of the GBAs was recorded together with notes on the general nature of the material. All plant taxa and other components were recorded using a four-point semi-quantitative scale: from 1 (one or a few specimens or fragments) to 4 (abundant, or a major component of the sample). Invertebrate remains were identified in the flot (for familiar species) or placed on damp filter paper for more careful inspection where necessary. The remains of adult beetles and bugs from a selection of the best preserved samples from the 2002 excavation were 'detail' recorded in the terminology of Kenward (1992). Adult beetles and bugs, other than aphids and scale insects, were recorded fully quantitatively and a minimum number of individuals estimated on the basis of the fragments present. Other invertebrate macrofossils were usually recorded semi-quantitatively using the scale described by Kenward et al. (1986) and Kenward (1992), again using estimates for extremely abundant taxa. Quality of insect preservation was recorded using the scales of Kenward and Large (1998). GBA samples from the 2003 harbour excavation were qualitatively assessed as an adjunct to the present work. The interpretative methods employed for insect and botanical remains were essentially the same as those employed in work on a variety of sites by Hall, Kenward and co-workers (see Kenward 1978, with modifications outlined by, for example, Kenward and Hall 1995).

Site riddled bone was recovered by on-site sieving (to 2 mm or 5mm) of excavated sediment from layers that were not otherwise sampled. Approximately 50% of this material was later selected for identification and recording, to which bone from the BS and GBA samples was added. Regardless of the method of field recovery, in the laboratory all mammal and bird bone retained by a 4 mm sieve and all fish bone retained by a 2 mm sieve was analysed. Moreover, mammal- or bird-bone fragments that passed through the 4 mm sieve were scanned for identifiable specimens, virtually none of which were found.

Feature Type	Site Period	Plot	Context	Intrasis sample	Charcoal abundance	Charcoal dim. mm	Barley	Other plant and non-plant components
Hearth, House 200	II	1	61643	63190	1	10		bark, herbaceous detritus
Hearth?	II	2	61359	61410	2	15		*Carex*, bone (burnt and unburnt), plant fuel ash
Hearth, House 302	II	3	76910	78141	2	20	1	bark
Hearth, House 302	II	3	77718	78274	2	15	1	*Carex, Chenopodium album, Potentilla* cf. *erecta*, unburnt bone
Hearth, House 303	II	3	84844	84895	1	10		
Floor, House 301	II	3	66085	66400	1 Q	10		plant fuel ash, *Corylus avellana* nutshell
Floor, House 303	II	3	64713	78923	1 F Q	10		
Floor, House 303	II	3	64713	81537	1	5	1	
Floor, House 406	II	2	69242	69305	2 C F Q	15	1	plant fuel ash, *Carex, Potentilla* cf. *erecta*, uncharred wood
Floor, House 406	II	2	69242	69306	2	10	1	plant fuel ash, *Corylus avellana* nutshell, cf. *Juniperus communis* (seed)
Floor, House 406	II	2	69242	69307	1	10		plant fuel ash (2), *Carex, Corylus avellana* nutshell, *Potentilla* cf. *erecta*
Floor, House 406	II	2	69242	69308	1 F Q	15		plant fuel ash (2), *Rubus fruticosus* agg.
Occupation	I	2	75167	75215	2	10	1	plant fuel ash
Occupation	I	2	75579	75679	1	15		plant fuel ash
Occupation, House 200	II	1	61670	62377	1	15	1	Gramineae, *Stellaria media*, unburnt bark, unburnt bone, plant fuel ash
Occupation, House 301	II	3	62023	63610	2	15	1	*Avena, Rosa*, bark, charred organic material
Occupation, House 301	II	3	62023	63865	1 A C F Q S/P	10	1	plant fuel ash, Carex, *Corylus avellana* nutshell, charred organic material
Occupation, House 301	II	3	62068	63864	2 A/C Q	10		plant fuel ash, *Corylus avellana* nutshell
Occupation, House 302	II	3	67217	71214	2	30	1	*Carex*, charred organic material
Occupation, House 302	II	3	76555	76884	2	15		*Carex, Galium aparine*, unburnt fish bone, plant fuel ash
Occupation, House 303	II	3	81762	82228	1 ?P Q			*Corylus* avellana nutshell
Occupation, House 303	II	3	81762	82229	2	15		*Corylus avellana* nutshell, *Rubus fruticosus* agg.
Occupation, House 303	II	3	81762	82227	1 Q S/P	20	1	cf. *Juniperus communis* (seed)
Occupation	I-III	2A-2B	78587	78680	2	15		plant fuel ash
Occupation	II	3A	82178	82311	2	15		plant fuel ash
Occupation	II	3A	85299	86599	2	10	1	*Chenopodium album, Galium aparine*, unburnt bark
Side Aisle, House 301	II	3	65556	66061	1	15	1	plant fuel ash, *Carex, Corylus avellana* nutshell, *Polygonum persicaria, Stellaria media*, charred organic material
Side Aisle, House 301	II	3	70806	71121	1 F Q S/P	20	1	plant fuel ash, *Corylus avellana* nutshell
Side Aisle, House 302	II	3	78497	78572	2	20	1	*Carex, Potentilla* cf. *erecta*, plant fuel ash
Side Aisle, House 406	II	2	68378	68451	1 F Q	25	1	plant fuel ash
Dumping	II	1	64612	64667	2	10		*Triticum/Hordeum*, plant fuel ash
Dumping	II	3	65597	66007	2	30		
Dumping	II	3	68717	68753	2	30	1	*Carex, Chenopodium album, Galium aparine*, charred organic material, plant fuel ash
Dumping	II	3	74121	74138	1	5		Cerealia indet., plant fuel ash
Dumping	II	3	74188	74292	2	30	1	bark, plant fuel ash
Dumping	II	3B	70602	73307	2	15	1	charred organic material, plant fuel ash
Dumping	II	3A-4B	71826	79086	2	15	1	cf. *Linum usitatissimum*, unburnt bark, unburnt cancellous bone and fish bone, plant fuel ash
Dumping	II	3A	83246	87783	1	10	1	*Carex, Polygonum persicaria*, unburnt bone, burnt fish bone, plant fuel ash
Dumping	II	3A	84296	84672	2	15	1	*Carex*, plant fuel ash

Feature Type	Site Period	Plot	Context	Intrasis sample	Charcoal abundance	Charcoal dim. mm	Barley	Other plant and non-plant components
Ditch	II	3	76697	77600	2	25	1	uncharred bark, plant fuel ash
Pit A82649	II	3	83319	83825	1	10	2	*Atriplex, Avena, Carex, Chenopodium album, Galium, Polygonum persicaria,* cf. *Secale cereale,* unburnt bark and cancellous bone, charred organic material (2), herbaceous detritus, plant fuel ash
Pit A43852	III	3	61237	83550	1	10		*Carex, Galium aparine,* charred organic material, fuel plant ash
Pit A65132	III	1	84282	84730	1	25		cf. *Secale cereale,* charred organic material, unburnt fish bone
Pit A74095	I-III	3	73950	74003	2	20		*Chenopodium album,* uncharred Rubus idaeus
Pit fill	II	3A	84615	84937	1	15	1	*Carex,* plant fuel ash
Layer	I	2	75001	75134	2	25		*Carex,* plant fuel ash
Layer	II	2	64458	64550	2	15	1	*Carex* (2), *Chenopodium album, Gramineae, Rumex,* bark, bone, plant fuel ash
Layer	II	2	74037	74111	2	25		*Carex, Potentilla* cf. erecta, Scirpus lacustris sl, Stellaria media, S. palustris/graminea, uncharred bark, plant fuel ash (2)
Layer	II	3	70696	71949	1	15		*Carex,* Chenopodiaceae, *Corylus avellana* nutshell, *Eleocharis palustris sl,* charred organic material, plant fuel ash
Layer	II	3	73520	78273	2	15	1	*Carex, Chenopodium album, Galium, Polygonum hydropiper,* cf. *Triticum,* bark, charred organic material, plant fuel ash
Layer	II	3	75751	75820	1	20	1	*Bilderdykia convolvulus, Carex,* cf. *Eleocharis* sp., *Secale cereale,* charred organic material, plant fuel ash
Layer	II	3	78143	78190	1	10	1	*Carex,* charred organic material, plant fuel ash
Layer	II	3A	76661	78003	2	20	1	*Carex,* Gramineae, *Plantago media, Ranunculus* Section *Ranunculus, R. flammula,* cf. *Triticum,* plant fuel ash
Layer	II	3	78393	78456	1	10	1	*Carex,* cf. *Secale cereale,* cf. *Triticum,* charred organic material, plant fuel ash

The bone assemblage was recorded following the York protocol, which is described by Harland et al. (2003). It entails the detailed recording of diagnostic elements, 17 for mammals, c. 20 for fish (dependent on species) and 8 for birds. These elements are identified to the finest possible taxonomic group and recorded in detail – typically including, as appropriate, element, side, count, measurements, weight, epiphyseal fusion, tooth wear, modifications (including burning and butchery), fragmentation, texture and estimates of fish size. Although identified as diagnostic elements, fish vertebrae are recorded in slightly less detail (measurements are not taken and texture is not scored, for example). 'Non-diagnostic' elements are only identified beyond class for special reasons. Examples include butchered specimens, birds (which are represented by only a few bones at this site), and other taxa that would otherwise not be recorded. These are indicated as presence data only in quantitative tables. For mammals and birds, the principle elements in the 'non-diagnostic' category are ribs and vertebrae.

The bones have been quantified by number of identified specimens (NISP), including all bones or only the diagnostic elements as indicated. Toothwear has been recorded using the methods of Grant (1982) for pigs and cattle, and Payne (1987) for caprines (sheep and goats). A detailed technical report and a digital archive have been submitted to the Kaupang Excavation Project and will be kept on file at the University of York. The small number of measurements in this archive follow von den Driesch (1976) and Harland et al. (2003), but they have not been analysed due to the shrinkage associated with burning (Shipman et al. 1984).

14.3 The material: an overview

Tables 14.1, 14.2 and 14.3 summarise the contents of a selection of BS light fractions, BS heavy fractions and GBA samples. A complete list of plant taxa recorded from the site is included in Appendix 14.1, and a list of 'useful' taxa along with their English and Norwegian common names is included in Appendix 14.2. A complete list of insect and other macro-invertebrate taxa is included in Appendix 14.3. The contents of the animal bone assemblage are summarised in Tables 14.4 and 14.5. A complete list of the mammals, birds and fish identified, with their Latin, English and Norwegian names, is included in Appendix 14.4. More detailed quantitative data regarding all of the ecofacts considered can be found in Barrett et al. (2004a).

In comparison with the preservation of plant material at some other sites of broadly comparable date – such as parts of York, Dublin and Hedeby – the preservation of plant material in the deposits from Kaupang examined for this study was rather limited, at least in terms of the range of taxa present, although those deposits with anoxic waterlogging generally yielded material of good quality. Such deposits were invariably the fills of pits. Surface-laid occupation layers, however, generally contained only small amounts of charred material, mainly charcoal, with a little charred hazel nutshell and some charred cereals (mainly barley) and weeds likely to have been growing with the cereal crop, and perhaps a few remains originating in burnt peat or turves. Other evidence of burning consisted of material variously recorded as 'ash beads', 'glassy ash' and 'ash concretions' – plant ash in small subspherical clasts or larger, more amorphous, whitish fragments – all no doubt originating in plant material. The few uncharred remains from surface-laid deposits are thought for the most part to be of recent origin. This is not surprising given the micromorphological evidence of extensive bioturbation by earthworms (Milek and French, this vol. Ch. 15:326–8).

Insect remains in the waterlogged deposits were usually diluted, so some of the groups recorded were small, but some of these small groups were useful for interpretation at the context level, and they contributed to the body of data for site-level analysis. The average concentration of insect remains in the recorded samples was low and none of the assemblages were very large, even after processing of quite large subsamples in some cases (the largest group was of 178 individuals from 7.0 kg of sediment from context AL88226, sample P88241). The concentration of adult beetle and bug remains, at 24 per kg (based on MNI) in the subsamples recorded quantitatively, was very low by comparison with beetle and bug remains in broadly similar deposits (Kenward and Hall 1995; Kenward 1988; Allison et al. 1999). However, for the Søndersø site at Viborg, Denmark, the value was 27 per kg (Kenward 2005). Whether these low concentrations are indicative of how the sites were used will depend on the taphonomy of the deposits in question (how long pits were open before being filled, for example), but it may be relevant that the Søndersø site was probably not intensively urbanised. In neither of these cases does post-depositional decay seem to have been responsible for the low concentrations: the deposits on which the estimates of concentrations are based were those with fossils, and almost none gave even hints that an appreciable proportion of the beetles at least had been completely lost by decay (the more delicate remains such as lice might have been, however). Overall, the most plausible explanation for the low concentrations of remains is that insect populations were quite restricted and that their remains were diluted by abundant plant debris. The implications of the insect remains for the intensity and permanence of occupation are discussed further in section 14.5 below.

Most of the botanical evidence from these deposits at Kaupang is of woody taxa, probably mostly originating from brushwood or other 'twiggy' litter – this might well be the source of, for example, juniper, and some heathland plants (especially various of the mosses). Wood chips from wood-working and/or construction might well have been used for litter in the first instance, too, rather than just being thrown away, though presumably their presence in pit fills indicates that their eventual fate was to be discarded (see section 14.4 below). Wood chips were a primary constituent of house foundations and floor layers in Viking-age Dublin, where preservation was better (Geraghty 1996). Grassland is represented in some deposits, with some freshwater marsh and saltmarsh taxa perhaps from cut vegetation or dung, but perhaps just arriving by natural dispersal from the nearby waterside of the fjord. There was perhaps also some imported turf, especially in the case of one sample (from pit A99030, Plot 2B, SP I) with waterlogged rhizome/culm fragments bearing a very characteristic "dried-unrewetted" appearance. Several other pit fills might have contained smaller components of rather similar material. It is tempting to see this as originating in turves used in roofing; the use of turves in roofing was a practice also known from the Dublin excavations (Geraghty 1996).

The insect remains were predominantly of species associated with, or at least often found in, decaying matter ranging from dryish mouldering plant debris to dung and animal remains. Species found primarily in natural or semi-natural habitats were rare and often typically associated with herbaceous vegetation. Insects associated with trees, whether living or dead, were uncommon. This ecological group was mainly represented by *Rhinosimus planirostris* and *Dromius quadrimaculatus* and *D. quadrinotatus,* the first associated at least as often with small dead twigs as with substantial timber, the last two living on trees,

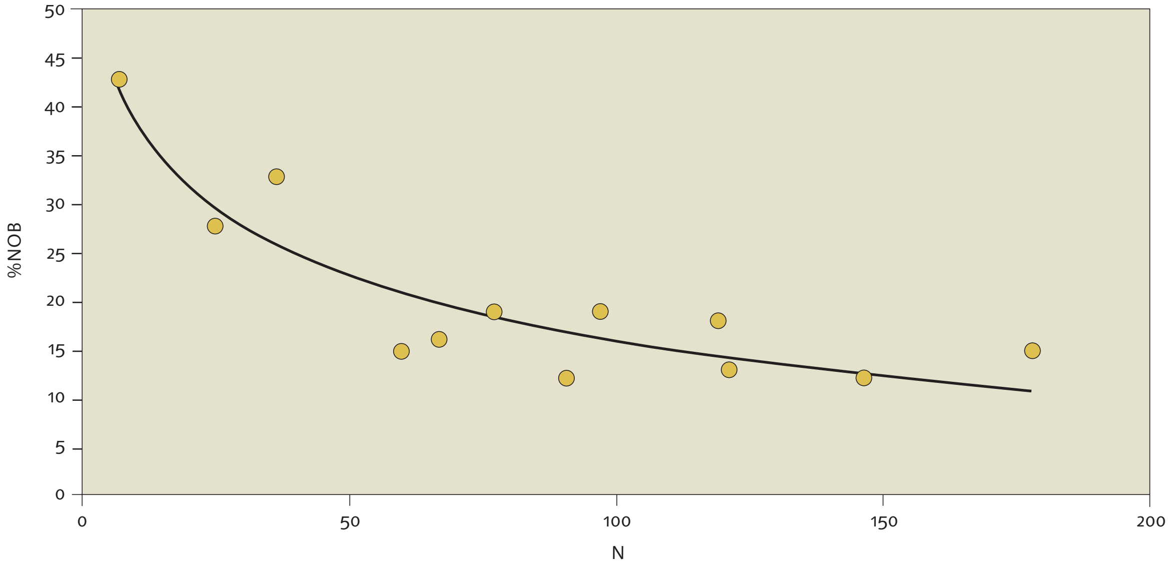
Feature Type	Site Period	Plot	Context	Sample	Original Sample Volume (l)	Density Gravel	Density Bone	Density Charcoal	Density Hazelnut
						(g/l, >4mm)			
Floor, House 303	II	3	64713	78923	10	118,28	0,16	0,44	0,00
Floor, House 303	II	3	64713	81537	10	100,91	0,06	0,05	0,00
Occupation, House 303	II	3	81762	82227	10	71,30	1,13	0,33	0,00
Occupation, House 303	II	3	81762	82228	10	76,48	2,41	0,33	0,01
Occupation, House 303	II	3	81762	82229	10	101,63	1,78	0,22	0,00
Occupation, House 406	II	2	69242	69305	10	38,84	3,16	4,45	0,00
Occupation, House 406	II	2	69242	69306	10	31,16	4,75	3,90	0,00
Occupation, House 406	II	2	69242	69307	5	49,52	8,60	6,48	0,00
Occupation, House 406	II	2	69242	69308	9	57,17	3,28	2,01	0,00
Occupation, House 301	II	3	62068	63864	7,5	29,45	7,29	0,19	0,03
Occupation, House 301	II	3	62023	63865	9	42,35	1,94	0,26	0,01
Occupation, House 301	II	3	66085	66400	11	26,08	0,20	0,29	0,02
Side Aisle, House 406	II	2	68378	68451	10	68,64	2,30	3,58	0,00
Side Aisle, House 301	II	3	65556	66061	10	35,80	2,30	0,82	0,03
Side Aisle, House 301	II	3	79806	71121	10	34,24	2,85	0,84	0,05

Feature Type	Site Period	Context	Intrasis sample	Gravel	Charcoal abundance	Charcoal maximum dim.(mm)	Wood or twig fragments	Bark	Wood chips	Hazel nut
Hearth (House 200)	II	61643	62381	3	1	10				1
Hearth (House 301)	II	47045		2	1	10				1
Dumping	II	68495	68512	2	3	10	1			
Pit A99030	I	99879	99948	2	3	20	3	2	2	1
Pit A65132	II	86018	86040	2	2	10	2	1	1	1
Pit A65132	II	86018	86385	1	1	5	1	1	1	1
Pit A65132	II	86018	86386	1	1	10	3	1	1	1
Pit A65132	II	86018	86387	2	1	15	1	2	1	1
Pit A65132	II	86018	87731	2	1	10	3	2	1	2
Pit A65132	II	86018	87732	2	1	20	3	2	2	1
Pit A43852	III	61411	87216	2	1	10		1 (ch)		
Pit A43852	III	87427	87447	1	2	20	1	1		1
Pit A43852	III	87626	87649	2	2	20	2	2	1	1
Pit A43852	III	87669	87679	2	2	20	2	1	1	2
Pit A43852	III	88226	88241	3	3	20	3	3	1	2
Pit A64891	III	65189	87792	2	2	20	1			1
Pit A64891	III	87793	87806	3	2	10	2	1	1	1
Pit (Heritage Management)	I-II	94901	94864	2	1	15	2	1		1
Harbour Spit 2	I-III	4453	4758	+			+	+	+	+
Harbour Spit 4	I-III	4453	4900		+	10	+	+	+	+
Harbour Spit 5	I-III	4453	4933S		+	10	+	+	+	+
Harbour Spit 6	I-III	4453	4950		+	10	+	+	+	+

Table 14.2 *Principal contents of the heavy fractions from 15 selected BS samples from building 'floor', 'side aisle' and 'occupation' deposits.*

Table 14.3 *Summary of the contents of 22 selected GBA samples (Numbers represent the four-point* semi-quantitative *scale of abundance outlined in the methods section (14.2); + indicates presence data only).*

Strawy material	Barley	Burnt bone	Unburnt bone	*Omosita*	Human fleas	Other notable inclusions	Comments
		1	1				
		1	1				
		1					very poor preservation, mostly charcoal & ash
+		1	1	+		rye, hemp, strawberry, hop, woad, raspberry, rose	some turf input; clean water & outdoor insects
+		1	1			raspberry, blackberry	very few insects
+					+	bee	compressed strawy material, some probably cereal but mixed, no parasite eggs, no insect evidence for use as animal bedding, small 'outdoor' insect component
+				+			compressed strawy material, *Apion* weevil implies hay
+	1			+		hop, strawberry, blackberry	compressed strawy material, insects are a typical range of occupation site decomposers
		1	1			flax, hop, hemp,	insects may imply waste from a building
+	1	1	1	+	+	flax, hemp, hop, woad, honey bee	plants and insects may imply redeposited floor material
		2	1				no insects observed
	1	1	1				poor preservation
		1	1	+		blackberry	insects imply dry animal matter, some possible indoor fauna
	1	1	1	+		hemp, raspberry, blackberry	insects imply dry animal matter
+	1	1	1	+		blackberry	insects imply dry animal matter
		1	1			raspberry	poor preservation
		1	1			flax, hop, raspberry, strawberry, blackberry	poor preservation
			1			raspberry	no identifiable insects
						blackberry	insects are decomposers & feeders of hay-like vegetation
						hop, woad, blackberry, flea (? species)	insects hint at decomposing floor litter, conceivably from a stable/byre
						blackberry, strawberry, rose, apple core	insects imply foul matter
	+				+	blackberry, rose, evidence of turf	one flea, but no unambiguous 'house fauna'



sheltering in bark crevices, but ranging onto twigs in search of prey (Lindroth 1986). There were a few bark beetles, probably imported with timber, but not enough to provide evidence of the relative importance of tree species. Even woodworm beetles *(Anobium)* were rare.

It has proved difficult to identify the specific uses of pits or the nature of conditions in the buildings from these deposits, in stark contrast to the evidence from sites such as 16–22 Coppergate, York (Kenward and Hall 1995), where many of the pit fills proved to be rich in faecal material, whilst another important component of the deposits in general was an abundance of remains of plants used in textile dyeing. Neither of these characteristics can be attributed to the Kaupang sediments based on the samples under consideration.

Nevertheless, many of the deposits at Kaupang contain an appreciable component of fauna presumed to have originated from within buildings ('house fauna'). It seems very possible that most of the deposits analysed here included material cleared from floors, perhaps predominantly waste from indoor processes rather than the debris of long-term domestic life (a contrast with many of the deposits at the Coppergate site in York). There were some records of human fleas *(Pulex irritans)* from two deposits, five being recovered from one of these, and three records of 'Siphonaptera', which were probably human fleas but which lacked easily identifiable parts (heads and genitalia). These were probably brought from within buildings in which they bred, but human fleas can also occur in stable manure deposits where the larvae could breed (and indeed the adults feed on livestock), and so are apparently not exclusively confined to human dwellings. No lice were found, though this might have been a result of the preservational regime rather than their absence when the deposits formed.

There was no coherent evidence for the presence of stable manure in the samples analysed (cf. Kenward and Hall 1997). Pale, soft, and apparently newly-emerged remains of *Apion* weevils were found in a number of the samples. Such remains are very typical of stable manure assemblages, in which they are frequently accompanied by a range of weevils and other insects found on herbaceous plants. In the context of Kaupang, however, they are likely to represent imported hay or turf rather than manure.

There were three assemblages with appreciable numbers of the beetle *Omosita colon,* together with a range of other species likely to have been attracted to dryish animal matter (including skins and bones). The possible significance of these samples is discussed in sections 14.4 and 14.7 below.

While imported plant resources demonstrate the presence of various kinds of vegetation within the catchment of Kaupang, the biota cast rather little light on semi-natural habitats on or immediately adjacent to the site, except for the consistent component of weed taxa, most of which might well have been growing around the settlement. Their numbers were much smaller than those in occupation deposits at some other sites of the period, however, and weed-associated insects were quite rare (cf. Kenward and Hall 1995). Indeed, outdoor insect fauna was remarkably limited in most cases, considering that the analysed waterlogged layers were all external deposits. The number of outdoor individuals is not proportional to assemblage size across the samples, the regression line showing a reduction in the importance of the outdoor component with increasing assemblage size (Fig. 14.1). This probably means that the larger assemblages included substantial autochthonous or imported communities, while the smaller assemblages were dominated by background fauna. This offers support to the argument that the more richly organic deposits consisted mainly of waste which either came from

Figure 14.1 *Plot of number of adult beetles and bugs (N) against percentage assigned to the 'outdoor' category (% NOB) for the assemblages from the Kaupang site. Logarithmic trend line added.* $R^2 = 0.83$. *Illustration by the authors.*

buildings or was very rapidly deposited and buried, so that insects could not breed in large numbers.

Fully aquatic invertebrates were present but were rare, with the exception of water-flea resting eggs (mostly *Daphnia):* overall, aquatic beetles and bugs accounted for only 1% of the fauna, far less than at many other sites. Fully aquatic plants were absent. Waterside insects were also rare (2% of site fauna), though some plants typically found by water sometimes occurred in quantity – especially celery-leaved crowfoot *(Ranunculus sceleratus),* and also several marsh/swamp taxa. There are three likely sources for aquatic and waterside remains in deposits formed as a result of intensive occupation: imported water, imported waterside resources, and flooding (occasionally, aquatics might have lived in pits, wells and ditches at many sites, but this seems to have been the exception in intensively used, urban or semi-urban areas). Given the quantity of evidence and the proximity of the site to the fjord, and the relative fall in the water level since the Viking Age, any or all of these mechanisms could have operated. There is a good chance that the "compressed straw" in one of the samples from context AL86018 included cut wetland vegetation, given the nature of some of the taxa present as fruits and seeds and perhaps also given some of the epidermis material which might well have come from culms (stems) of large sedges or emergent plants such as bulrush or sea club-rush *(Scirpus* spp.), although it could not be identified with certainty (see section 14.4 below).

The presence of quite large numbers of water-flea eggs and the absence of other aquatics perhaps would support an argument for imported water rather than flooding (a much richer fauna being expected from the latter). Flooding does seem to be a possibility, however, from the rather abundant (but small) fragments of colonial coelenterate stems noted during botanical analysis. It may be more likely, however, that these arrived with seaweed (of which there is some evidence from the charred plant remains) or shellfish (of which the only evidence from these samples was traces of bivalve periostracum, any calcareous shell components probably having dissolved) (cf. Buckland et al. 1993). There were small quantities of salt-tolerant plants such as sea arrow-grass *(Triglochin maritima)* in the deposits, probably no more than casual arrivals from nearby fjord-edge communities.

A very modest range of food taxa was represented amongst the plant remains. As far as 'staples' are concerned, there were low concentrations of cereals (as charred grains), mainly barley (the most frequently recorded plant taxon, though only twice present at more than very low concentrations), with a little rye and oats, but with no certainly identified wheat. This is entirely consistent with what might be expected in the Kaupang area at this period; furthermore, a low concentration of charred cereals was also found in Viking-age Dublin (Geraghty 1996). Wild foods included rose, blackberry, raspberry, strawberry, apple and perhaps rowan. There were no clearly cultivated fruits and no evidence of importation of exotic fruits.

Hemp and hop were both recorded in pit fills. Hemp is likely to have been a fibre crop, though its use as food for human or animal consumption and as an oil-seed, like flax, cannot be discounted. Hop might have been used for flavouring beer (see section 14.6 below). Amongst the plants recorded at Kaupang, only woad stands out as being likely to have been used for dyeing textiles (although many of the wild plants could conceivably have served this purpose). Flax (linseed) was also identified.

Although first introduced to Norway in prehistory, woad, hemp, flax and the cereals would all have been locally available in the Viking Age. All of the other plants recorded from Kaupang are native to Norway and all might have grown in the vicinity of

Type	Site Period I	II	III	I-III	Disturbed	Unphased	Total
Bird							
Side aisle		3					3
Ditch		3		1			4
Dumping		1					1
Floor		1					1
Hearth		1					1
Layer	1	6					7
Occupation		2					2
Pit			5				5
?					3		3
Fish							
Agricultural horizon					5		5
Animal burrow					1		1
Side aisle		163	1				164
Ditch		58	11	82			151
Dumping		120					120
Feature		6					6
Floor		66					66
Hearth		20					20
Layer	40	214		2	2		258
Occupation	1	19					20
Passage		37					37
Pit	8	22	540	1			571
Posthole				1			1
Road					1		1
Stakehole				1			1
?					71	4	75
Mammal							
Agricultural horizon					1516		1516
Animal burrow					17		17
Side aisle		1641	252				1893
Ditch		4815	804	4163			9782
Dumping		7753					7753
Feature		615					615
Floor		1533					1533
Hearth		829					829
Layer	2376	21607		834	53		24870
Occupation	881	6842					7723
Passage		2951					2951
Pit	153	29	5248	235			5665
Posthole			100	115			215
Road					102		102
Stakehole				25			25
Stonepacking				27			27
?					3616	189	3805
Total	3460	49357	6961	5487	5387	193	70845

Table 14.4 *Distribution of all bone by phase and context type.*

the site. A single positive identification was made of a honey bee, *Apis mellifera,* and there were two tentative identifications, but these are not enough to demonstrate bee-keeping (compared with the abundant bees from Oslo (Kenward 1988), York (Kenward and Hall 1995) and Aberdeen, Scotland (Hall et al. 2004).

These results are broadly comparable with those of Buckland et al. (2001) regarding samples collected during the CRM excavation at Kaupang in 2000. For example, a "superabundance" of *Omosita colon* beetles was also noted in pit A28375 and, to a lesser degree, pit A9422. However, minor differences do occur. Finds from the CRM excavation of 2000 which were not represented in the 2002 material include wheat, from pit A5190, and lice *(Damalinia* sp.), probably sheep lice *(D. ovis),* from pit A1625. Dung beetles also occurred in this well, and in pit A1635, possibly suggesting that these features served in part as watering holes for livestock (Buckland et al. 2001).

Turning to the faunal evidence, in total, 70,845 animal bone specimens were examined from Plots 1A-3B. All site periods and context types were dominated by mammal bone (69321), followed by fish (1497) and bird (27) (Tab. 14.4). There were, however, some differences in the relative abundance of fish and mammal bones across the site (see section 14.4 below). Of the large assemblage recorded, only 1506 specimens were diagnostic elements that could be attributed to taxonomic categories below class (Tab. 14.5). Of these, 855 were mammal, 639 were fish and 12 were bird. The tiny percentage of identified bone was due to extremely poor preservation.

Most of the Kaupang bone assemblage was burned. This pattern applies to both the mammal (75% burned) and bird (63% burned) assemblages. Perhaps surprisingly, however, only 27% of the fish bone was clearly burned. This last pattern is partly explained by the high proportion of fish recovered from pits, the fills of which were waterlogged and exhibited better preservation conditions. For example, whereas only 21% of fish bones from pits were burned, 62% of the fish bones from ditches were burned. The predominance of burned mammal and bird bones is almost certainly due to poor preservation conditions. For complex chemical and mechanical reasons they have been found to survive in acidic soil conditions (e.g. Nicholson 1996).

The poor preservation at Kaupang is also evident from the high level of fragmentation of the bones. Based only on the identified diagnostic elements (the bones which were measured), among the largest specimens in the collection, the mean fragment size for mammal bones was only 27.2mm. This is extraordinarily small in an assemblage dominated by large species such as pigs, cattle and caprines (sheep or goats). Moreover, the vast majority of identified specimens represented less than c. 20% of a complete element and the unidentified bone typically consisted of very tiny fragments. The preservation of the unburned bones can also be assessed based on their texture (Harland et al. 2003). It is consistently poor, with the exception of fish bone from pits, where a few "good" and one "excellent" texture states were noted.

The very poor preservation conditions would have reduced the absolute quantity of bone at Kaupang to a large, but unmeasurable, degree. They have also reduced the identifiable component of the assemblage to a tiny fraction of the total. More importantly, however, they would have had a major impact on the relative representation of taxa and elements which therefore cannot be accurately modelled (Lyman 1994; Costamagno et al. 2005). From what is known about bone survival, the combination of excellent recovery methods, high fragmentation, poor bone-tissue preservation (texture) and preservation by burning is likely to produce unusual patterns where, for example, small robust bones survive to a greater degree than large ones (e.g. Nicholson

	Site Period						
Type	**I**	**II**	**III**	**I-III**	**Disturbed**	**Unphased**	**Total**
Bird							
Barnacle goose		present	1				1
Brent Goose		1					1
Eider		present					
Shelduck		1					1
Domestic Fowl		3	3		1		7
Great Black-backed Gull					1		1
Little Auk		1					1
Subtotal		6	4		2		12
Fish							
Shark, Skate & Ray Orders		1	3				4
Dogfish Families			1				1
Eel		1					1
Atlantic Herring	1	66	177	12	7		263
Salmon & Trout Family		8					8
Trout		1					1
Cod Family	5	74	27	13	8	2	129
Cod		70	26	9	8		113
Ling		14	2	1	2		19
Pollack	1						1
Saithe	2	48	13	4	6		73
Hake		16	1	6	1		24
Gurnard Family		1					1
Wrasse Family			1				1
Subtotal	9	300	251	45	32	2	639
Mammal							
Large mammal	3	33	17	7	5		65
Medium mammal 1	6	47	18	10	10		91
Medium mammal 2		8		1			9
Shrew species			1				1
Dog family		1	present		3		4
Cat		26	2	5			33
Cat?		2		1			3
Horse		2		1			3
Pig	9	228	41	23	33	1	335
Pig?	1			1	1		3
Deer			1				1
Red deer			1				1
Cattle	10	116	22	17	16		181
Sheep/goat	5	84	13	7	11	1	121
Sheep		2					2
Hare		2					2
Subtotal	34	551	116	73	79	2	855
Total	43	857	371	118	113	4	1506

Table 14.5 *Number of identified bone specimens (NISP) by site period of all species based on diagnostic elements (other records noted as present only).*

1995; Bond 1996). As discussed below, this is in fact what emerges from the Kaupang assemblage.

The very small mammal assemblage identified is dominated by four domestic taxa: pigs (NISP = 338), cattle (181), caprines (123, probably including both sheep and goats, although only the former were definitively recognised) and cats (36). Moreover, 91 pig- or sheep-sized (medium mammal 1) specimens can probably be divided disproportionately between these two taxa, and 65 large mammal identifications are almost certainly cattle given the virtual absence of deer (represented only by one red deer antler tine and a worked antler comb tooth) and horse (represented by only three specimens). In sum, therefore, these common domestic taxa constitute approximately 98% of the mammal assemblage. The remaining trace species include the deer and horse just mentioned, four dog or wolf (probably large dog) specimens, two hare bones and one shrew bone (which can probably be considered a natural introduction to the site). Particular attention was paid to the possible inclusion of other wild taxa, such as the fur-bearing species recovered at Birka (Wigh 2001), but it is clear that they were not present in the material analysed from Kaupang. All of these patterns are consistent with the smaller assemblage from the CRM excavation at the site in 2000 (Hufthammer and Bratbak 2000).

The 639 identified fish bones were dominated by marine species, with eel and salmonids being the only possible prey of fresh water (although they can also be caught in the sea). Eleven main taxa were identified, but five species constitute most of the assemblage: herring (NISP = 263), cod (113), saithe (73), hake (24) and ling (19). Moreover, another 129 cod family specimens can probably be divided between cod, saithe and ling. These five taxa are thus likely to constitute c. 97% of the fish assemblage. However, five mineralised vertebral centra from cartilaginous fish, perhaps dogfish, may under-represent the importance of this group as they produce few other ossified structures. The remaining taxa include the above-mentioned salmonids (nine specimens, of which one was probably trout), and one specimen each of eel, pollack, gurnard and wrasse. This assemblage is broadly similar to the collection from the CRM excavation (Hufthammer and Bratbak 2000), but it has a higher proportion of herring and exhibits minor differences in the representation of trace taxa. Flatfish were not represented in the 2002 material for example, although they were present in the 2003 harbour assemblage.

Although the Kaupang fish bone assemblage is tiny compared to some, it is similar in scale to many from Viking-age Europe and is better recovered than most (cf. Enghoff 1999, 2000; Barrett et al. 2004b). The site riddled material will be heavily biased by the poor preservation discussed above, but 38% of the fish assemblage was from pit fills which were at least partly waterlogged and produced some good-quality fish bone. The Kaupang material may thus be of interpretive value.

Only a few of the 27 bird bones recognised in the assemblage could be identified beyond the level of class. Twelve were diagnostic elements following the York recording protocol, but a few additional specimens were also identified (Tab. 14.5). Overall, seven bird species were identified. Nine specimens were firmly identifiable as domestic fowl ("chicken"), and many of the specimens only identifiable as "bird" were probably domestic fowl. The identifications were all made on elements on which this species can be clearly distinguished from other galliform birds such as pheasant *(Phasianus colchicus)* or black grouse *(Lyrurus tetrix)* (see Erbersdobler 1968). The other species reflect Kaupang's coastal location. Two specimens were identified as barnacle goose, one as brent goose, one as shelduck, one as eider duck, one as great black-backed gull and one as little auk.

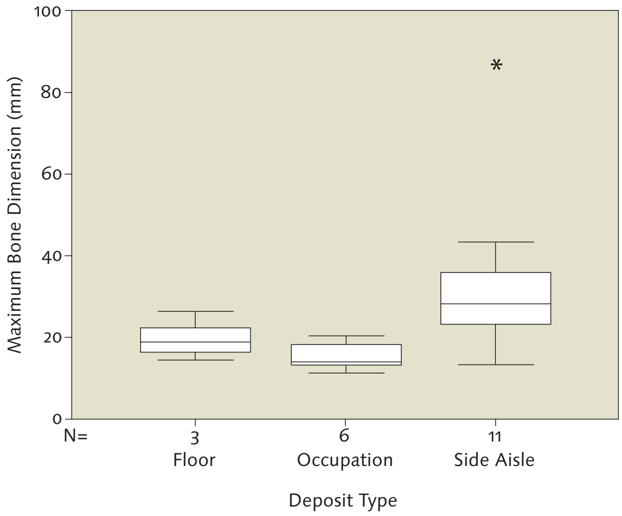


Figure 14.2 *Maximum dimension of identified mammal bones from house "floor", "occupation" and "side aisle" deposits. Illustration by the authors.*

Zooarchaeological goose bone identifications have been shown to be problematic (Barnes et al. 1998, 2000), but the small species in question are not among the taxa which can be easily confused. The little auk identification was made on the distal half of a left ulna, which was lightly charred. However, the morphology of the ulna is distinctive in alcids, and the specimen was closely compared with other alcid species and with other birds of a similar size. Despite the imperfections of the specimen, the identification is made with confidence.

As noted above, the poor preservation and small sample size of the ecofactual material from Kaupang limits its interpretive potential. Nevertheless, it can contribute to our understanding of a series of thematic issues, ranging from the character of specific features to the super-regional context of the settlement. Each of these themes will now be considered in turn.

14.4 The features: hearths, occupation deposits, dumps, pit fills and harbour deposits

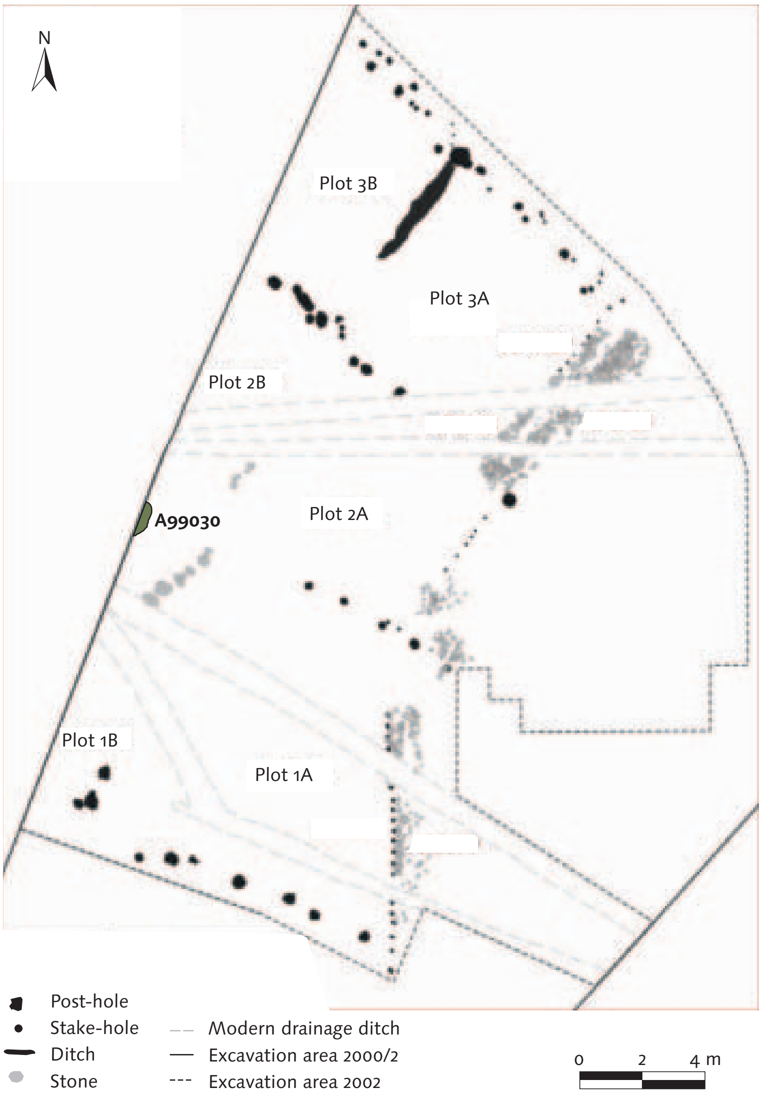
The main feature types sampled were hearths, floor and occupation layers, side aisle layers, dumps, pit fills, harbour deposits and undefined "layers". Based on the sediment micromorphology evidence (Milek and French, this vol. Ch. 15) one can approach the samples with several hypotheses in mind: that floor and occupation deposits were augmented by sweepings from the hearths, that side aisle deposits resembled occupation deposits in the central aisle with less evidence of trampling, that dumps were largely composed of redeposited occupation deposits and that the harbour deposits were predominately composed of woodworking debris (no micromorphology samples of pit fills were analysed). The micromorphology evidence also suggests that gravel and sand were sometimes laid as primary floor deposits and that cut vegetation (possibly as straw mats), wood chips and bark were occasionally significant components of floor litter. These interpretations can be corroborated and augmented using the evidence under consideration in this chapter. The ecofacts also add information regarding the pit fills, and suggest that the harbour deposits were largely redeposited occupation material.

Before considering the evidence, however, it is necessary to sound a cautionary note. The interpretations drawn below regarding specific feature types rely on an assumption that the sampled material was in situ rather than being residual or intrusive. This would be a naïve hypothesis on multiperiod sites where middens overlie houses and vice versa with much mixing and disturbance. At Kaupang, however, the period of occupation appears to have been limited, and the maintenance of plot boundaries also prescribed the use of space during the lifetime of the site. Moreover, samples with relatively unambiguous field interpretations are the focus of this consideration.

To begin with the hearth samples, these produced charcoal, charred bark, charred barley grains, charred hazelnutshell and fragments of burnt and unburnt bone (Tab. 14.1). These materials were then spread onto the floor and occupation layers within the houses. Charcoal and plant fuel ash are ubiquitous in these feature types and charred hazel nutshell, charred barley grains and bone fragments are also common in small numbers. Some floor and occupation deposits were also particularly rich in gravel-sized stone (Tab. 14.2). It might have been purposefully deposited as a living surface, a practice documented in later Viking-age Dublin (Wallace 1992; cf. Milek and French, this vol. Ch. 15:337).

The few side-aisle samples examined were very similar to the material from floor and occupation layers and must also have received redeposited hearth waste. The side aisles were different, however, in that they included slightly larger fragments of bone (Fig.

Figure 14.3 *Location of pit A99030 from Site Period I. Illustration, Julie K. Øhre Askjem.*



14.2). This may be consistent with the interpretation, based on the micromorphology evidence, that they received less traffic and suffered less trampling. In the well-preserved houses of Viking-age Dublin, side aisles consisted of slightly raised platforms of brushwood and organic material over a base of generic floor material (the latter of which typically had a high concentration of wood chips). The objects found in the Dublin side aisles (such as hazel nutshells) were less fragmented than elsewhere in the houses, presumably because they fell down among the brushwood and were thus protected from trampling and cleaning (Geraghty 1996). Similar features might have existed in the less well-preserved buildings at Kaupang.

Like the interior deposits, the exterior dumping layers are characterised by charcoal and plant fuel ash with occasional bone fragments and charred barley grains (Tab. 14.1). This pattern is consistent with the suggestion noted above that they are largely composed of redeposited occupation deposits (Milek and French, this vol. Ch. 15:354). However, the dumps do seem to be missing the hazel nutshell characteristic of interior deposits at Kaupang. Much of this midden material might thus have come directly from its source (charcoal and ash from hearths) rather than via occupation deposits. The one "whole earth" GBA sample examined from dumping layers was composed mostly of charcoal and ash (Tab. 14.3). This is not to say that occupation layers were never redeposited on exterior middens, but it does seem likely that the latter were mainly created by the direct dumping of hearth waste.

All of the evidence discussed thus far has derived from material preserved without the benefit of waterlogging – mainly by charring. Fortunately, a few pit fills and the harbour deposits were waterlogged, leading to the preservation of both unburnt plant material and insect remains. It is therefore possible to infer more about the formation of these features and (indirectly) about the floors and possibly roofs from which some of the material probably came.

The pits which produced waterlogged material were sufficiently small in number to make it worth treating them individually (Tab. 14.3; see Figs. 14.3–14.5). Starting with SP I, one GBA sample from pit A99030 on Plot 2B was studied. It included much charcoal, but also gravel and uncharred wood fragments, bark, wood chips and strawy material. Hazel nutshell was represented, along with woad, raspberry and plant remains characteristic of turf. Burnt and unburnt bone fragments were present along with the remains of insects characteristic of clean water and outdoor environments. This feature was not used as a cesspit, but its original function is unclear. It seems possible, however, that it received some redeposited floor litter. Many of the charred inclusions match what was found in the BS samples from internal deposits, and both wood chips and strawy material were identified as probable flooring by sediment micromorphology (Milek and French, this vol. Ch.

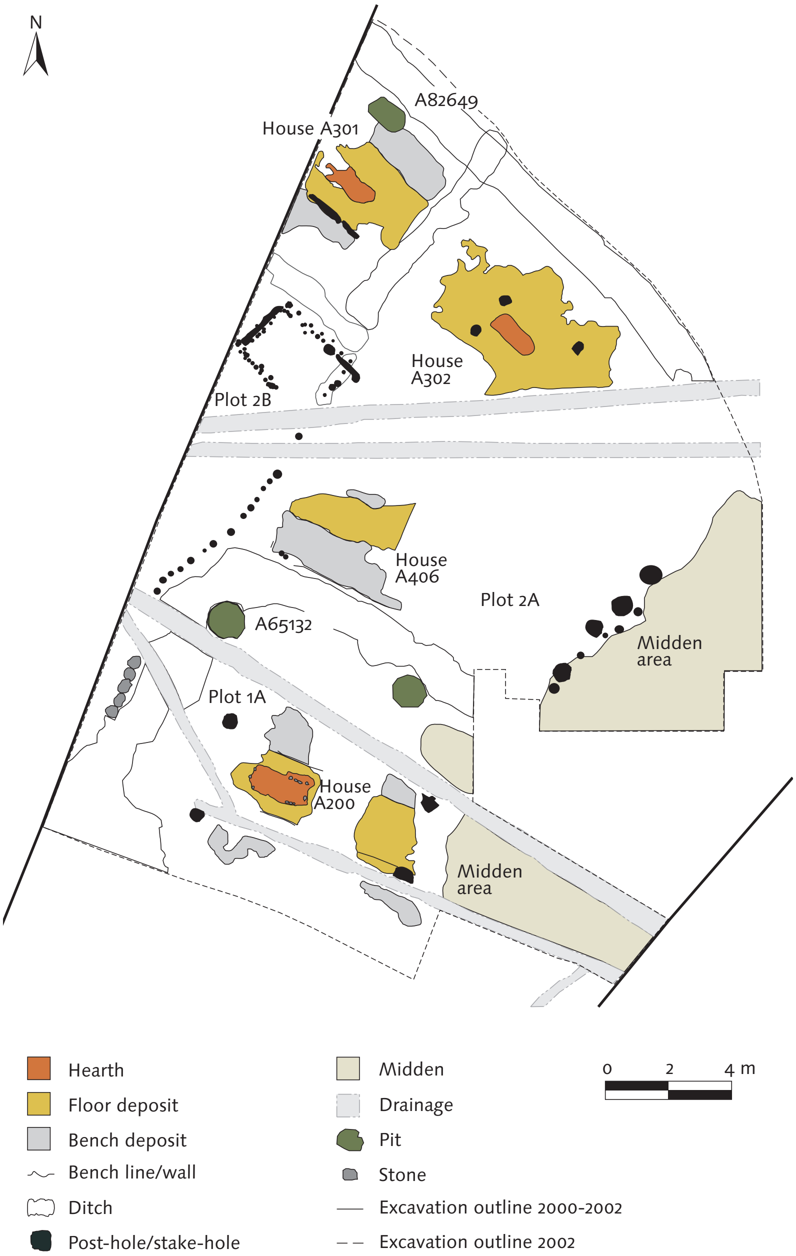


Figure 14.4 *Location of pits A65132 and A82649 from Site Period II. Illustration, Julie K. Øhre Askjem.*

Figure 14.5 *Location of pits A43852, A65132 and A64891 from Site Period III. Illustration, Julie K. Øhre Askjem.*

Figure 14.6 *Compressed strawy material from context AL86018 of pit A65132, Site Period II. Illustration by the authors.*

15:345, 348). The evidence of imported turf could also represent roofing material. As has been noted in passing above, these interpretations find parallels in the buildings of Viking-age Dublin (Geraghty 1996).

A clearer picture emerges from pit A65132, of Plot 1A, SP II, for which six samples from context AL86018 were analysed (poorly preserved upper fills of pit A65132 from SP III are not considered here). This pit was characterised by well-preserved compressed strawy material which was probably a mix of true cereal straw and other plants such as grasses, sedges and moss shoots (Fig. 14.6). The material was not finely comminuted as would typify herbivore dung and no parasite eggs were identified. Moreover, there was no insect evidence to suggest the material's use as animal bedding. Instead, the samples produced a recognisable suite of house-floor inclusions: gravel, charcoal, wood fragments, bark, wood chips, occasional barley grains and burned and unburned bone. Traces of useful plants – flax, hemp, hop, woad, strawberry, raspberry and blackberry – were present. The insects, including two human fleas, also suggested waste from inside a building. In sum, whatever its initial function, this pit was probably filled with house-floor sweepings once it went out of use, possibly from house A200 on Plot 1A, SP II.

The possible use of strawy material as house-floor litter requires brief elaboration in light of the micromorphology evidence. Milek and French (this vol. Ch. 15:348, 354) note the presence of wavy lenses of phytoliths in layers interpreted as in situ or redeposited occupation surfaces. These were interpreted as possible evidence of woven grass mats. Such mats might have existed at Kaupang, but no fragments have been preserved in the waterlogged GBA samples and the compressed straw from pit A65132 suggests that cut vegetation was also simply spread on the floor.

The fills of pit A43852 from Plot 3B, SP III, may also represent material redeposited from inside a building. Five samples from five separate contexts were studied. These were all very similar, with the caveat that two exhibited poor preservation. Overall, the fills were characterised by the now familiar combination of charcoal, gravel, wood fragments, bark, wood chips, hazel nutshell, occasional barley grains and both burnt and unburnt bone fragments. One sample also produced strawy material and the pit included evidence of hemp, raspberry and blackberry. No human fleas were identified, but one sample produced some possible indoor fauna.

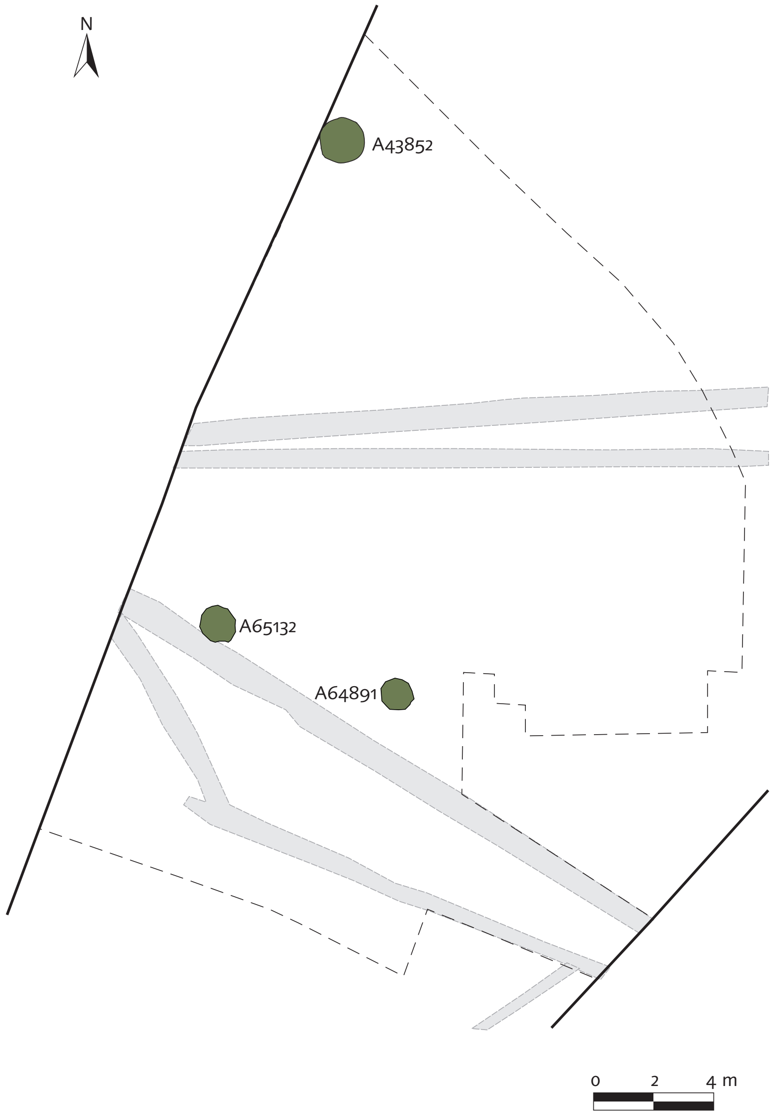
The fills of this pit resembled others from the site in many ways, but the pit was also distinctive in producing an insect assemblage dominated by two taxa: *Omosita colon* and a *Ptinus* sp. *O. colon* is found in decaying matter, typically bones, dry carrion or old skins. *Omosita* and perhaps also the *Ptinus* sp. might have been exploiting a variety of materials at the Kaupang site; one hypothesis is that the *Omosita* and perhaps also the *Ptinus* sp. had invaded stored skins before they (and/or detritus from them) were discarded in the pit. This line of argument is supported by the record of an adult (?identification) and two larvae of the hide beetle *Dermestes lardarius,* found in decaying animal matter, sometimes in houses and birds' nests. Elements of the remaining fauna might have come from indoors (notably *?Tenebrio obscurus),* and many might have been attracted to hides or bones, but are not necessarily characteristic of skins or decaying animal matter. Smaller numbers of *Omosita* were also recorded in pits A99030 and A65132, which could be taken to imply that similar habitats existed at the site in periods I and II. As noted above, a "superabundance" of *Omosita colon* beetles was also found in pit A28375 and, to a lesser degree, pit A9422 from the CRM excavation in 2000 (Buckland et al. 2001).

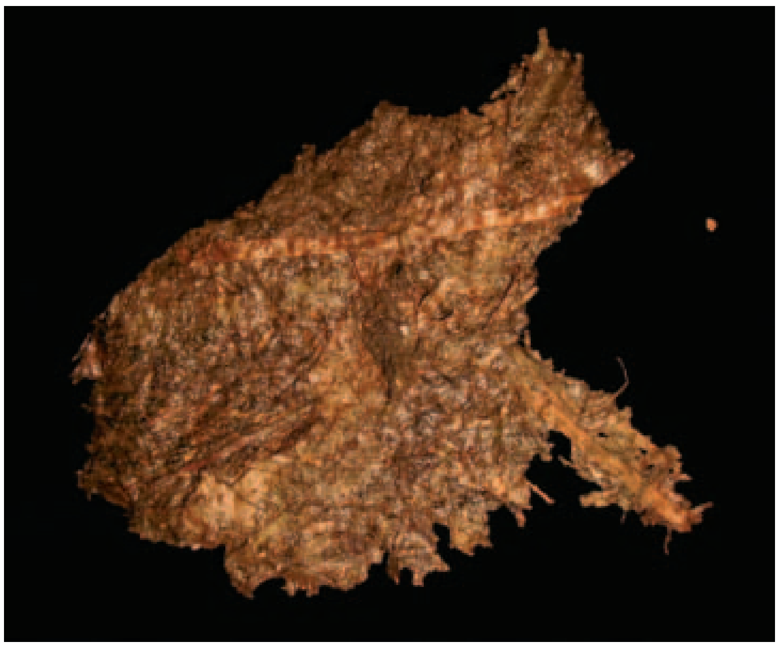
The presence or absence of stored skins, conceivably furs, at Kaupang is highly relevant to the interpretation of the site's long-range trade connections (see section 14.7 below). It is also possible, however, that the insects described above were simply attracted to dry bones which might originally have been discarded in the pits at Kaupang in great numbers. Only fragments of bone survive at Kaupang, but pits were explicitly used for animal bone disposal at other broadly comparable sites such as Melbourne Street from Middle Anglo-Saxon Hamwic (Southampton) in England (Bourdillon and Coy 1980). Pit A43852, with its abundant *Omosita,* also produced a rich bone assemblage for this site (some of it from the samples yielding these distinctive insects).

The pit produced a total of 3,403 bones. Most were small fragments and only 328 specimens (236 fish, 87 mammal and 4 bird) were identified beyond the level of class. Nevertheless, this is a significant proportion of the total identified bone from the site, particularly in the case of fish. The main fish taxa represented were herring, cod, saithe, ling, dogfish, hake, and shark or ray. The mammal taxa were cattle, pig, caprine, cat, deer (one red deer antler tine and a comb tooth of unidentified antler) and shrew. The only identified bird specimens were of domestic fowl. These bones are not consistent with waste from fur preparation or skinning.

The fills of pit A64891, from Plot 1A, SP III, were more poorly preserved. Nothing can be inferred from the insects, but sample 87806 produced charcoal, gravel, wood fragments, bark, wood chips, hazel nutshell, burnt and unburnt bone, flax, hop, raspberry, strawberry and blackberry – typical occupation-deposit refuse.

Waterlogged deposits from the Viking-age har-





bour sediments were similar to the pit fills in many ways, but they lacked gravel and strawy material. Wood fragments, twigs, bark and wood chips dominated the matrix of all four samples examined. They also contained charcoal, hazel nutshell, barley, hop, woad, apple core, blackberry, strawberry and (in one sample) evidence of turf. Bone was not recorded during the GBA assessment, but it was collected by hand from the harbour deposits so the absence of this category from Table 14.3 should not be taken as significant. The insects were only assessed qualitatively, but hinted at decomposing floor litter (probably from a house, but conceivably a byre or stable). A single human flea was identified.

Based on intra-site micromorphological comparisons, the harbour deposits have been interpreted as waste from woodworking activity (Milek and French, this vol. Ch. 15:355). Assessment of the GBA samples, which represent a larger volume of material than the soil thin sections, may qualify this conclusion. The layers exhibit a number of inclusions – from charcoal and hazel nutshell to a human flea – which are consistent with occupation deposits on house floors. As discussed above, the wood chips and other woody debris are also consistent with floor litter – if perhaps incidentally as a by-product of woodworking. The discrepancy between the micromorphology and GBA evidence may be due to a combination of two factors. The first of these is the above-mentioned difference in the volume of material examined using the two methods. The second is that interpretation of the micromorphology samples is necessarily based on comparing waterlogged harbour sediments (where inclusions are very diluted by abundant preserved organic material) with freely drained floor deposits (where inclusions are concentrated by decay of most of the organic component).

Having suggested that the harbour samples may partly derive from floor litter, the paucity of gravel and the lack of strawy material must be revisited. These materials were common in deposits interpreted as floor litter above (principally pit fills). Their paucity in harbour samples may be due to sorting by wave-action or a discrepancy in chronology between the harbour layers and the pits of Plots 1A-3B. Alternatively, the harbour deposits may be a mixture of occupation and woodworking waste, the latter possibly from the construction of jetties or similar structures in the harbour itself.

In the discussion thus far, animal bone has only occasionally played a part in the interpretation of specific feature-types. This is to be expected given the poor preservation at Kaupang, but a few general patterns are worth noting. Firstly, only 14 fish bones (11 herring, 2 cod and 1 cod family) from the site were crushed, conceivably by mastication. Crushed herring bones have been interpreted as evidence of human cess in other contexts (cf. Wheeler and Jones 1989), but none of the Kaupang fish bones exhibited the complementary signs of partial digestion. The crushed bones may thus indicate trampling rather than ingestion. Along with the insect and plant remains, this evidence suggests that cesspits were not among the features sampled in the 2002 excavation.

The small sample of identified bone makes it difficult to evaluate intra-site patterning by feature type. Only a few observations are likely to be meaningful, and even these sometimes relate to preservation conditions rather than structured deposition. Pits and side aisles are particularly rich in fish bone – with ratios of fish:mammal of 0.1 and 0.09 respectively, compared to the site average of 0.02. In the case of pits, this probably relates to anoxic preservation conditions, but the same cannot be said of side-aisle deposits. In the latter case, more fish bone may have survived due to lower levels of trampling during the formation of the deposits. Within the pits, it is particular contexts rather than all pit-fills that are rich in fish bone. In pit A43852, for example, it is only contexts AL61411, AL87427, AL87626 and AL87669 that produced high ratios of fish:mammal. Similarly, in pit A65132 only context AL86018 was unusually rich in fish. It may be relevant that in pit A43852 the largest fish assemblages came from layers relatively low in the pit stratigraphy and therefore presumably most consistently waterlogged. Among the pits, it is A43852 which stands out as unusually rich in fish bone (with 517 specimens and a fish:mammal ratio of 0.18). By building, house 406 (Plot 2A) has a slightly elevated concentration of fish bone (210 specimens from floor and side aisle layers, producing a fish:mammal ratio of 0.12).

At the species level, with the exception of some patterning in the cat data discussed below, the broad characteristics of the mammal assemblage are repeated across those phases and context types for which sample sizes justify comparison. Structured or ritual deposition of animal bones is a characteristic of some European contexts of the first millennium AD (e.g. Campbell 2000; Wigh 2001), but there is no evidence that particular mammal taxa or elements were assigned to specific pits or other features at Kaupang. Overall, the rank order of pigs>cattle>caprines is repeated in most context types, including pits, with cattle and caprines occasionally reversing their order of abundance in cases where sample sizes were small (dumps, for example). As discussed below in section 14.6, however, the importance of pigs may be exaggerated by preservation conditions favouring small robust foot bones. Cattle were more abundant in the better preserved harbour deposits, but in all cases sample sizes are very small.

Most of the cat specimens derive from ditch fills (e.g. contexts AL68122, AL68504 and AL75386), predominately from SP II. One small group of cat bones from context AL68122 (the fill of a ditch dividing

Plots 3A and 3B in SP II) probably represents skinning (see section 14.7).

The sample size of the fish assemblage is too small to subdivide by feature-type and phase, but it is notable that the rank order of herring and cod (the two most abundant taxa) does differ across space and time. In particular, cod is the more abundant of the two in SP II, whereas herring is more common in SP III (Tab. 14.5). These differences can be explained in spatial terms. Most of the herring bones are from pit A43852, belonging to SP III.

14.5 Seasonality and permanence

Despite poor preservation, the ecofactual evidence from Kaupang can shed some tentative light on the question of the settlement's seasons of occupation and degree of permanence. If summer occupation is taken as given, the critical question is whether the settlement was occupied continuously throughout the year – particularly in winter. This issue can be addressed by consideration of migratory bird species and, in an indirect way, the representation of synanthropic insects in the waterlogged deposits.

As noted above in section 14.3, only 27 bird bones were recognised in the assemblage and few of these could be identified beyond class. These records are important, however, as the only possible indicators of year-round occupation at Kaupang in the zooarchaeological assemblage. After domestic fowl ("chickens", nine specimens), coastal and marine birds predominate. Of the latter, two specimens were identified as barnacle goose and one as brent goose. Both species breed in the Arctic and disperse around the coasts of northwestern Europe for the winter. One specimen of little auk was also identified. This species also breeds in the Arctic, dispersing to sea at high latitudes during the winter.

All three species are likely to have been caught outside the summer months, but before drawing conclusions it is necessary to consider the migratory behaviour of each species in detail and to recognise that breeding and wintering distributions can undergo changes through time. It must also be kept in mind that birds can be preserved for later consumption (Serjeantson 1998).

Of the three species under consideration, the little auk provides the strongest evidence. It breeds in the high Arctic and disperses at high latitudes (particularly among broken pack ice) during winter, principally from October to April. During this period, small numbers are sometimes found as far south as Skagerrak, and wrecks of little auks can also be blown south by prolonged gales (Snow and Perrins 1998). The single specimen of this species was found in context AL70553, a deposit in the ditch between Plots 1A and 1B in SP II.

The brent and barnacle geese are probably indicative of spring or autumn occupation rather than mid-winter. Two populations of brent geese are potentially relevant to Kaupang. One breeds in the Russian tundra and winters in the Netherlands, southeastern England and western France. A second breeds in Spitsbergen and Franz Josef Land and winters in northeastern England (Snow and Perrins 1998). The Russian tundra breeders migrate through the Baltic in mid-September to early October, typically passing through southern Scandinavia in October-November. During their return migration they leave southern Scandinavia in May-June. The Spitsbergen and Franz Josef Land breeders migrate down Norway's west coast, gathering in southern Scandinavia in early October before moving on to England. On their return, they pass through northwestern Denmark in April-May. If these migration patterns were similar in the Viking Age, the brent goose specimen from Kaupang is thus likely to represent a spring or autumn catch. It was from context AL67217, an occupation layer in house 302 of Plot 3A, SP II, sub-phase 2.

There are three main migratory populations of barnacle geese (Snow and Perrins 1998). One breeds in Greenland and winters in Ireland and western Scotland, one breeds in Spitsbergen and winters in the Solway Firth (on the Anglo-Scottish border) and one breeds in northern Russia and mainly winters in the Netherlands. The Greenland population was unlikely to have come within the range of Kaupang's inhabitants. The Spitsbergen population presently migrates down the west coast of Norway (conceivably bringing it within range of the settlement's economic catchment) in September, returning in April/May. More realistically, the northern Russian population migrates over southern Scandinavia in August/September and March/April. In sum, the barnacle geese from Kaupang were most likely to have been caught during their migrations in late summer/early autumn or late winter/early spring. However, a few pairs of this species (c. 40 in 1996) have actually started breeding in Norway in recent decades (Snow and Perrins 1998), suggesting that they might also have done so in the distant past. Thus they are less convincing indicators of year-round settlement than the little auk and (to a lesser degree) the brent goose specimens. One of the barnacle goose bones was found in context AL74188, a dumping deposit of SP II, sub-phase 2 on Plot 3A. The other was from context AL60829, a pit deposit of SP III on Plot 3B.

Although many of the plant remains found are indicative of summer and autum, there is no botanical evidence from Kaupang that can be said to corroborate or refute year-round occupation. The same applies to the insect remains, with the caveat that the synanthropic component of the fauna may have implications regarding the degree of permanence of the settlement.

	Kaupang	Viborg	Coppergate	Oslo	Deer Park Farms	Buiston
% SA	48	33	55	62	54	36
% SF	33	21	24	33	9	26
% ST	14	13	24	28	12	10
% SS	0	0	7	1	33	0

Table 14.6 *Percentages of categories of synanthropic fauna in the amalgamated insect assemblages from Kaupang and other sites (see text). SA – all synanthropes; SF – facultative synanthropes; ST – species which are typically synanthropic; SS – strong synanthropes.*

	Kaupang	Viborg	Coppergate	Oslo	Deer Park Farms	Buiston
SF as % SA	70	62	44	53	18	71
ST as % SA	30	37	43	46	21	29
SS as % SA	1	0	14	2	61	1

Table 14.7 *Internal structure of the synanthropic fauna in the amalgamated assemblages from Kaupang and other sites (see text). SA – all synanthropes; SF – facultative synanthropes; ST – species which are typically synanthropic; SS – strong synanthropes. Data for Deer Park Farms are strongly skewed by the abundant* Aglenus brunneus: *see Table 14.8.*

It has been suggested (Kenward 1997) that analysis of the synanthropic insects (those species favoured by human activity) from archaeological deposits can provide a range of information about the character and use of sites. This has indirect implications for seasonality. Where the favourable habitats created by humans are missing for part of each year, a synanthropic insect fauna will be prevented from developing to the same degree as in a settlement continuously occupied for many years. This relationship is not, however, a straightforward one. The abundance, diversity and character of the synanthropic insect fauna would also have been influenced by: the ultimate length of occupation (years, decades or centuries), the character and density of settlement (how urban it was), and the intensity of external contacts through which the insect populations were introduced (and/or augmented).

The synanthropic component at Kaupang was distinctive, with a large proportion of facultative synanthropes (common in natural as well as artificial habitats), few typical synanthropes (typically associated with humans, but able to live in nature) and almost no obligate or strong synanthropes (absent from or very rare in natural habitats in the relevant geographical area) (Tab. 14.6). While this evaluation is based on analysis of a limited number of deposits of a restricted range of types (no floors, for example), and the whole-site assemblage is fairly small (1,024 adult beetles and bugs), it is hard to believe that it differed greatly from the fauna of the site as a whole. Many of the assemblages had high diversity and are almost certainly rich in background fauna, which should mean that they represent an "averaged" fauna for the site, and others appeared to contain material dumped from within buildings; so it is clear that "house fauna" has been sampled.

The statistics for the site fauna as a whole thus show that synanthropes were not as strongly represented as in some other occupation sites. However, the comparative figures are sometimes substantially affected by the presence of other components, for example the strength of the outdoor fauna, and at two of the comparative sites by *Aglenus brunneus,* which can be extremely abundant. The first problem is easily overcome by examining the internal structure of the synanthropic fauna (Tab. 14.7). This shows that species designated as facultative synanthropes (likely to have colonised from natural habitats as well as artificial ones, though it should be remembered that the classification is inevitably somewhat arbitrary) were far more important at Kaupang than at the broadly contemporaneous site of Coppergate, York, or at the small isolated rural site of Deer Park Farms, County Antrim, Northern Ireland (Allison et al. 1999; Kenward 1997; Kenward and Allison 1994; Kenward and Hall 1995). Indeed, this component gives a value closest to that of the isolated lake-dwelling at Buiston, Ayrshire, Scotland (Kenward 1997; Kenward et al. 2000) and of the essentially rural workshops at Viborg, Denmark (Kenward 2005). Facultative synanthropes were important in occupation deposits at the medieval "Søndre Felt" site in Oslo (Tab. 14.7), suggesting the possibility of regional differences. However, the large proportion of facultative synanthropes at Søndre Felt was the result of the abundance of a small number of species in a few samples, and the synanthrope fauna of the site as a whole was rich and well developed. This simply serves as a reminder that species composition must be examined, rather than relying simply on summary statistics.

The proportion of facultative synanthropes probably reflects the degree to which more specialised synanthropes – much less likely to have been abundant in the wild locally, and therefore relying on trade and the passage of time – had been able to colonise and survive. Although a few species thought to be more specialised had arrived, presumably as a result of trade (e.g. *Aglenus brunneus* and *Tenebrio obscurus),* the data for the Kaupang site appear to suggest relative isolation, a new and short-lived settlement, or intermittent occupation.

These comparative figures are somewhat skewed by the presence of abundant *Aglenus brunneus*, which probably bred in the deposits post-depositionally, at Coppergate and Deer Park Farms. Removing *A. brunneus* (Tab. 14.8) emphasises the similarity between Deer Park Farms and Coppergate, and between Kaupang, Viborg and Buiston, with Søndre Felt somewhat intermediate. The values for the typical synanthropes emphasise the similarity between the intensively occupied sites at Coppergate and Oslo.

There was a slight, but statistically insignificant, increase in the proportion of synanthropes in the assemblages through time, but no pattern in the variation of the internal structure of the synanthrope component. Unfortunately, It was thus not possible to address the question as to whether the site was permanently or seasonally occupied in the various site periods – there were too few deposits containing appreciable numbers of insects in each phase to provide an objective assessment. Nevertheless, the extremely limited synanthrope fauna, and the predominance of facultative forms, may be indicators of seasonal or intermittent occupation for at least part of the settlement's lifetime, large populations of typical or strong synanthropes being unable to develop in a short period of occupation, and (if occupation was in summer) not having artificially warmed places for wintering. Seasonal occupation could also account for the rather limited abundance of annual nitrophile weeds in comparison with other occupation sites. Alternatively, the poorly developed synanthropic fauna may imply a relatively short overall lifespan for the intensive occupation at Kaupang (if one assumes, based on the artefactual evidence, that external contacts were frequent and widespread).

	Kaupang	Viborg	Coppergate	Oslo	Deer Park Farms	Buiston
SF as % SA	70	62	48	53	44	71
ST as % SA	30	37	47	46	53	29
SS as % SA	0	0	5	1	3	1

Table 14.8 *Internal structure of the synanthropic fauna in the amalgamated assemblages from Kaupang and other sites (see text), after removal of* Aglenus brunneus. *SA – all synanthropes; SF – facultative synanthropes; ST – species which are typically synanthropic; SS – strong synanthropes.*

14.6 Provisioning and relationships with the hinterland

A major role of ecofact studies in urban archaeology is to study how towns and their precursors were provisioned (e.g. Prummel 1983; Crabtree 1996; Wigh 2001; O'Connor 2004; Enghoff, in prep. a). Did Kaupang's occupants produce their own food (as has been argued for Dorestad for example (Prummel 1983)) or rely on an extensive hinterland (as suggested for Fishergate in York for example (O'Connor 1991))? Moreover, if the town was provisioned by a hinterland, can the structure of the ecofact evidence shed any light on how this exchange was organised (cf. O'Connor 2001)?

To begin with arable agriculture, the pollen evidence from Kaupang suggests local cereal cultivation until the time of Kaupang's occupation, followed by cessation of this activity until late in the Middle Ages (Sørensen et al., this vol. Ch. 12:271). Sørensen et al. thus tentatively suggest that local cultivation stopped when the settlement was founded, which would have necessitated significant provisioning from distant sources. Barley grain is ubiquitous in the samples we have studied from the site and oats and rye have also been recorded. Wheat has been found in one sample from the CRM excavation in 2000 (Buckland et al. 2001).

Given the imprecision of radiocarbon dating (on which the pollen evidence relies), and the relatively short (c. 150-year) occupation of Kaupang, one could alternatively argue that agriculture dwindled in the region only after the settlement was abandoned. One scenario that could have accounted for this pattern would have been that the land had remained owned by elite patrons (and had thus been unavailable for use) despite the decline of the urban site. The interpretation that agricultural activity declined around Viking-age Kaupang does require a specific explanation. It runs counter to the widespread expansion of farming observed in northwestern Europe in the centuries leading up to the end of the first millennium AD (e.g. Karlsson and Robertsson 1997; Fossier 1999; Macklin et al. 2000).

In light of the above, it is difficult to say if the barley, oats, rye and (to a lesser degree) wheat consumed at Kaupang were locally produced or imported. Possible imported rye was recognised by measuring grains from the 10th-century fortress of Fyrkat in Denmark (Robinson 1991 and references therein), but early Viking-age evidence of the large-scale shipment of grain is not known to the authors. No large concentrations of grain suitable for metrical analysis were recovered from Kaupang. There is, however, evidence of cereal straw, so some local production can be assumed. Moreover, the absence of grain pest insects argues against the presence of large quantities of stored imported grain on the site (Kenward and Williams 1979; Buckland et al. 2001). It is conceivable that small quantities of wheat, for example, were traded over long distances, but in sum it seems probable that most or all of the cereals used at Kaupang were produced in its hinterland.

The sparse remains of flax (linseed, mostly from pit A65132, but with a record of capsule fragments from A64891) represent a plant useable for fibre, as food or a source of oil. There is no reason to think that it represents imported material, so this crop might also have been grown in Kaupang's hinterland.

Local cultivation of hemp is also probable given the remains of this plant found in some of the pit-fill samples. It was recorded at Kaupang in small amounts from two pits and more frequently in two of the fills of a third (A65132). This is most likely to have been a fibre crop, though its use as food for human or animal consumption and as an oil-seed is also possible. Almost all of the material from Kaupang comprised achene fragments, which may indicate breakage during processing for food or oil extraction. In the hinterland of Birka in the region around lake Mälaren, Sweden, hemp was probably introduced early in the first millennium AD and was increasingly cultivated during the Viking Age (Karlsson and Robertsson 1997).

Although a native plant, hop may also have been grown or purposefully collected. It was present in trace amounts in two pits, but rather frequent through the fills of pit A65132, reaching an abundance of 3 (on the 4-point scale used) in two samples from context AL86018. Behre (1983, 1984) has described the finds of hops from Hedeby, and put them in the context of early medieval use of plants as flavourings for beer. This plant was frequent at Coppergate (Kenward and Hall 1995), and has also been recorded at Birka, Sweden (Hansson and Dickson 1997), and Novgorod (M. Monk, pers. comm.), whilst Aalto and Heinäjoki-Majander (1997) have demonstrated its importance in 9th-/10th-century deposits at the Viking-age town of Staraja Ladoga in western Russia. The use to which the hops were put does seem most likely to have been related to flavouring beer, though the plant is credited with other uses such as in dyeing.

In contrast to the rich evidence for dye plants in York (Kenward and Hall 1995, and a more recent synthesis by Hall and Kenward 2004), only woad stands out amongst the plants recorded at Kaupang as being likely to have had this purpose (although certainly many of the wild plants might have furnished colour for textiles). It is difficult to see why woad remains were present in the Kaupang deposits (in single fills in each of two pits, but also recorded from a sample from the "harbour area" recovered during the 2003 excavation) unless it had been brought for use in dyeing – though it is a successful coloniser of certain kinds of disturbed soils (having, for example, become a pernicious weed in parts of North America following introduction by European settlers). Woad is well known from the Viking Age in southern Norway from its presence in the Oseberg ship-burial (Holmboe 1927).

A variety of other plant resources must also have been collected from the settlement's hinterland. A variety of tree species provided building material, firewood and (perhaps incidentally) twig and woodchip floor litter. Cut strawy vegetation was also collected for this purpose and turf may have been cut (conceivably for roofing). Hazelnuts were a ubiquitous snack food and the seeds of a variety of berries made their way into the settlement's deposits. Apples were also eaten. The limited waterlogged preservation at Kaupang made the study of possible coppicing practices impossible, but some level of woodland management seems probable given the vast amount of fuel that the settlement must have required. Many of the deposits studied in this chapter and by micromorphology (Milek and French, this vol. Ch. 15), were at least partly composed of wood ash and charcoal. However, the necessary forested land must have been some distance from the settlement given the paucity of insects associated with trees (see section 14.3, above).

The plant (and indirectly also the insect) remains thus imply the existence of a substantial hinterland around Kaupang, which one can speculate either controlled or was controlled by the settlement's inhabitants or patrons. Without such an inalienable link it is difficult to envision how the settlement could have functioned.

The animal bone both corroborates and modifies this interpretation. The relevant evidence includes the species represented, the ages at which they were (or were not) killed and the ways in which they were butchered. In large, well-preserved, faunal assemblages these and other variables (e.g. bone measurements) can shed detailed light on hunting, fishing, husbandry and provisioning practices (e.g. Prummel 1983; O'Connor 1989; Wigh 2001; Schmölcke 2004). Given the extremely poor bone preservation at Kaupang, however, one's objectives must be modest and one's interpretations tentative.

The first observation to make is that there was a virtual absence of wild mammal remains (with the exception of one red deer antler tine, a worked antler comb tooth, two hare bones and one shrew bone). As noted in section 14.3 above, this pattern is clear despite carefully examining all 70,845 specimens for evidence of other wild taxa.

The paucity of remains of wild mammals (many of which would be forest dwellers in a Norwegian context) is also consistent with the virtual absence of freshwater fish remains and the complete absence of "inland" wild bird remains from the site. It would seem that the wild resources of the settlement's terrestrial hinterland were not exploited. The fish assemblage is dominated by marine species, with eel (one specimen) and salmonids (salmon or trout, nine specimens), which inhabit both marine and freshwater environments, being the only possible prey from rivers, lakes or streams. After domestic fowl ("chickens", which were presumably kept in the settlement), coastal and marine birds predominate, with no taxa indicative of fowling undertaken inland from the site.

This pattern is consistent with some other proto-urban settlements of broadly comparable date, such as Fishergate in York (O'Connor 1991) and Melbourne Street ("Hamwic") in Southampton (Bourdillon and Coy 1980). However, it differs from others, such as Ribe (where fish caught in fresh water were more abundant: Enghoff, in prep. b) and Birka (where furbearers were common: Wigh 2001). At Fishergate in York, this limited species diversity has been interpreted as evidence that the settlement's food supply was provided (and thus controlled) by an elite patron (O'Connor 1991). A semi-autonomous urban population might be expected to exert a greater level of consumer choice and thus produce a more diverse faunal assemblage – as is evident in later sites from York such as 16–22 Coppergate (O'Connor 1989). A similar interpretation may be relevant to Kaupang (although use was made of coastal birds and a number of marine fish species). Later medieval towns in Norway, which were fully urban, produced slightly more remains of wild mammals and inland birds (e.g. Lie 1988, 1989; Hufthammer 2000, 2003). The lack of remains of furbearers is discussed further in section 14.7 below.

The domestic mammals identified were mostly pigs, cattle and caprines (sheep or goats) – with smaller numbers of cats (36 specimens), dogs (probably 4 specimens) and horses (3 specimens). The main body of material, from Plots 1A–3B, was notable in producing a rank order of pig>cattle>caprines. A relatively high proportion (or occasionally dominance) of pig bones is consistent with broadly Viking-age centres in the Baltic region and western Jutland such as Birka, Hedeby, Groß Strömkendorf, Menzlin and Ribe (e.g. Reichstein and Tiessen 1974; Hatting 1991; Wigh 2001 and references therein; Schmölcke 2004). Moreover, the earliest (11th- to 12th-century) phase of medieval Oslo also produced a relatively high proportion of pig bones (Lie 1988; see also Hufthammer 2003). Thus this pattern could be interpreted as an extreme expression of an "eastward-looking" husbandry and provisioning system – possibly with an element of environmental determinism given the evidence of forest in Kaupang's hinterland and thus availability of local pannage.

This hypothesis is weakened, however, by the observation that pigs were also very abundant in late Viking-age Irish towns, particularly Dublin (e.g. McCormick 1997, 2005). In these instances, the pigs are thought to have been stall-raised "in town". The pattern is therefore interpreted as evidence of strained political relations between Hiberno-Norse centres and their Irish hinterlands – which might otherwise have been expected to provision the towns (McCormick 2005). A similar interpretation could conceivably apply to Kaupang, given the tentative identification of a pigsty at the site (Pilø, pers. comm.). It seems more likely, however, that pigs were abundant at Kaupang and other "eastern" centres because of the availability of extensive tracts of forest for pannage within their hinterlands.

It is also possible that the species representation at Kaupang might simply have been very biased by the unusual preservation and recovery conditions of the site. If it is correct that small robust elements have been favoured, the high proportion of pigs is partly due to taphonomy and the fact that they have four developed digits, compared with the two of cattle and sheep.

The finds from the Kaupang harbour excavation in 2003 may shed additional light on the relative importance of pigs. Here they were less abundant than cattle. This difference may simply reflect the tiny sample size of the harbour assemblage, patterned refuse-disposal practices or sorting by wave-action. However, given that preservation was better in the harbour the dominance of pigs in the rest of the site may well be a taphonomic bias, at least in part.

The aging evidence for pigs (and all species) is poor due to tiny sample sizes and the taphonomic impact on the elements that are best represented (making epiphyseal fusion data of limited value). Nevertheless, it is worth noting that no pig deciduous fourth premolars were recovered and that almost all permanent fourth premolars and first to third molars were unworn or in early stages of wear (Barrett et al. 2004a). This may imply that the pigs were killed between their first and second year based on Silver's (1969) tooth-eruption data.

Pigs are typically killed young because most are kept for meat rather than for breeding stock. However, the complete absence of piglets is notable. It is probably due to the poor preservation conditions (immature bone is particularly susceptible to destruction), but could alternatively imply that pigs were not usually raised within the settlement. Instead, Kaupang might have been provisioned with forest-herded pigs from farms in the countryside as discussed above (cf. Crabtree 1994; Verhulst 2002). Theoretically, this hypothesis could be tested by studying the diet of the pigs using stable isotope analysis. Unfortunately, however, there was insufficient collagen preserved in the bones from Kaupang (Richards, pers. comm.).

The pigs consumed were probably all domestic even if they were herded in a forest hinterland. The material was not conducive to osteometric analysis (due to fragmentation and burning), but where it could be observed tooth-size and -morphology were entirely consistent with domestic pigs (Payne and Bull 1988; Rowley-Conwy 1995). The pigs would presumably have been herded "into town" given that most parts of the skeleton are represented (with a quantitative bias towards small robust elements such as the metapodials, tarsals and phalanges consistent with preservation by burning). Cut marks on the pig bones, including a scapula, humerus, pelvis and femur, are most consistent with disarticulating whole skeletons on site.

Notable exceptions to the otherwise complete skeletal representation of pigs are the upper and lower canines. They are missing from the Plot 1A–3B collection despite their distinctive appearance and the preservation of other pig teeth. They have not been separated from the assemblage as artefacts (Pilø, pers. comm.), leaving curation in the Viking Age or anomalous preservation as possible explanations. Given their recovery from the Kaupang harbour deposits, where preservation was slightly better, the latter interpretation seems most likely.

Like the pigs, the cattle from Kaupang are represented by all parts of the skeleton, with a bias towards teeth and the small robust elements of the feet. Cut marks on a radius, two femora and three metapodials are consistent with disarticulating the skeleton (probably during primary butchery) and (in the case of the metapodials) hide removal. A single horn core indicates the presence of a horned "breed", but it was too fragmentary to yield statistics regarding size or shape. The aging evidence suffers from the problems noted above regarding pigs, but once again it may be meaningful that no deciduous fourth premolars were recovered (Barrett et al. 2004a). If this is not due to the poor preservation of juvenile teeth, it implies that the cattle were butchered at some point after approximately 2 years of age (although a very few unfused early-fusing elements, such as proximal phalanges, were present in this collection and a few juvenile cattle bones were also noted in the harbour assemblage). The wear stages of the permanent teeth imply that the Kaupang cattle were not kept into old age either. For example, at least some were killed between approximately 24 and 30 months based on unworn third molars. The one complete mandible from the site, found in pit A65132 of Plot 1A, included teeth with the most advanced wear states in the collection. Its third molar was in Grant's (1982) stage G, probably indicating an age of greater than 5 years (Grigson 1982).

The paucity of calves at Kaupang could be due to the tiny sample size or poor preservation of juvenile bone. Alternatively, it could imply that the settlement was not raising cattle. In the latter case it would have been provisioned from hinterland farms. In at least some cases (the individuals with unworn third molars) the cattle were killed as prime meat animals of nearly adult size. The Kaupang evidence is too incomplete to read much into this observation, but a focus on beef consumption (rather than the local production of dairy products, for example) has been observed at comparable settlements. Examples include Dorestad (Prummel 1983) and 16–22 Coppergate, York (O'Connor 1989). Annalistic references regarding medieval Dublin can be employed to bring this practice to life. In the 12th century thousands of cattle were driven into town from neighbouring kingdoms to pay for mercenary services (Holm 1986).

Two of the caprine specimens, a skull fragment with horn core and a distal tibia, were identified as sheep (the former more definitively than the latter). The rest were undifferentiated, so it is not possible to indicate whether goats were present at Kaupang. Goats were very common however, at later medieval urban sites in Norway (Lie 1988; see Hufthammer 2003), so it is probable that both species were present. As with the pigs and cattle, a range of skeletal elements was recovered implying the presence of complete caprine carcases at the site. The familiar bias towards robust foot bones and teeth is also observable. No cut marks were noted on specimens identified as sheep or goat. Tooth wear could only be assessed on five isolated specimens, all of which are consistent with adult "sheep" rather than old individuals or "lambs". Most of the observable epiphyses were also fused, indicating mature animals. Although these aging indicators are superficially consistent with meat and perhaps wool rather than milk production, the problem of small sample size is particularly acute for this group of animals. Some comparable settlements (e.g. Ribe, see Hatting 1991) have produced significant numbers of old caprines interpreted as evidence of wool production. Others, such as Birka (Wigh 2001) and 16–22 Coppergate, York, (O'Connor 1989) have produced mostly sub-adult and young adult caprines (younger than approximately four years) interpreted as multi-purpose meat and wool producers. In any case, at Kaupang they were presumably brought "to town" to be slaughtered for their meat. Alternatively, the putative goats among the material may have been kept in the settlement as multi-purpose milk, meat, horn and hide producers (cf. Lie 1988).

Little can be said about the tiny numbers of horse and dog bones identified, except to note that horse is typically uncommon at comparable proto-urban sites (Wigh 2001) and that dogs might have been more numerous at Kaupang than the four identified specimens imply. Thirty-two mammal and three fish bones exhibited clear carnivore tooth impressions consistent with dog gnawing. Cats are discussed in section 14.7 below.

As noted above, most of the identified fish and bird bones are from coastal or fully maritime species. The cod, saithe, ling and hake were probably caught from boats using traditional hand lines in relatively deep water (cf. Vollan 1974; Sørheim 2004; Olsen 2004). Ling and hake prefer particularly deep water, but can sometimes be found relatively close to shore – during summer in the case of hake (Whitehead et al. 1986). These four taxa represent a fishery distinct from the herring, which were probably caught by net (Sørheim 2004), although coastal traps can also be effective (von Brandt 1984). Nets are indirectly evidenced at Kaupang, due to the numerous recoveries of netsinkers (Pilø, pers. comm.). As noted above, the nine salmonid specimens identified (one of which may have been a trout based on the criteria of Feltham and Marquiss 1989) could have been caught in either fresh or salt water – probably by hook, spear or net (von Brandt 1984). The Lågen River, which is renowned for its salmon fisheries, meets the sea close to the Kaupang site.

Little can be said of the cartilaginous fish, as their mineralised vertebral centra could not be identified to species. If dogfish however, as suspected, they could have provided both food and oil (cf. Lie 1988). The remaining trace taxa probably represent incidental catches. The wrasse specimen (a vertebra which could only be identified to family) is interesting insofar as it may imply some fishing in the inter-tidal zone (Whitehead et al. 1986). The single gurnard, a common food of large gadids such as ling (Muus and Dahlstrøm 1974), may be the only indication of gut contents in the assemblage. In the site riddled material this lacuna could be a recovery bias, but this seems unlikely in the pit fills where tiny herring bones were well represented (unless some of the herring themselves were gut contents from the large gadids). Fish might thus have been partly prepared off-site. As discussed below in section 14.7, however, there is no evidence of the long-range trade of dried or salted fish to or from this site.

Domestic fowl aside, the bird bones also represent exploitation of the coast or sea, possibly at some distance from the settlement. The barnacle goose, brent goose and little auk specimens have already been discussed in section 14.5 above. Two other waterfowl were identified: one specimen each of shelduck and of eider duck. Eider duck were numerous in the assemblages from Hedeby (Reichstein and Pieper 1986:53–4) and Birka (Ericson 1987). Ericson (1987) has suggested that the eider from Birka had been hunted along the coast of central Sweden using air nets (typically strung between two islets) and transported over considerable distances to the town. A single specimen of great black-backed gull, also a coastal bird, may represent an opportunistic scavenger, but gulls do seem to have been eaten in some regions of northern Europe during the Viking Period and Middle Ages (cf. Serjeantson 1988; Hufthammer 2003).

In sum, the ecofactual evidence suggests that Kaupang must have controlled or drawn on a productive hinterland stretching well beyond the settlement's immediate environment. Inland, it relied on an extensive (but probably local) agricultural and wooded hinterland. To seaward, its occupants might have utilised an equally (or perhaps more) extensive maritime hinterland.

14.7 Long-range trade

Although the artefacts from Kaupang are clearly indicative of long-range trade, the same cannot be said of most of the ecofacts. To begin with the plant remains, with the exception of woad, hemp, flax and the cereals, all of the plants recorded from Kaupang are native to Norway and all might have grown in the vicinity of the site. Moreover, the crop plants would all have been introduced first before the 9th century. Thus none is significant in terms of possible trade connections. There were no clearly cultivated fruits and no evidence of importation of exotic fruits – in contrast to the figs and grape pips from medieval Oslo, for example (Griffin 1988).

In the same vein, the poorly developed synanthropic insect fauna at Kaupang could also imply modest levels of trade. It is equally possible, however, that this pattern was a result of the limited overall life-span of the settlement or periodic (at times possibly seasonal?) abandonment (see section 14.5).

As noted in section 14.3 above, during analysis of the bone assemblage particular attention was paid to the possible inclusion of fur-bearing species, such as the squirrel, fox, brown bear, pine marten, polecat, wolverine, badger, otter and lynx recovered at Birka (Wigh 2001). It is clear, however, that they were not present. This observation is considered to be conclusive, given the fine level of recovery at Kaupang, the bias towards preservation of small bones at this site and the fact that 70,845 specimens were examined. The pattern is also consistent with the smaller assemblages recovered during the CRM work in 2000 (Hufthammer and Bratbak 2000) and the harbour excavations in 2003.

The only convincing evidence of skinning of any species at Kaupang is one group of cat bones from context AL68122 (the fill of a plot division ditch between Plots 3A and 3B, SP II). It included tarsals, metatarsals, phalanges and a caudal vertebra – presumably deposited while processing (or disposing of) a cat pelt. Cat remains are relatively common finds at broadly contemporary sites in Europe (e.g. Crabtree 1989; Hatting 1990; Wigh 2001; O'Connor 2004); cats often served as a source of fur, and also acted as predators of commensal pests, and presumably as pets (the wild cat, *Felis silvestris,* is not recorded in the fauna of Norway). Cats were particularly common in medieval Oslo (Lie 1988; Hufthammer 2000). Two hare bones from Kaupang, a metatarsal and a phalanx, could conceivably also relate to skinning, but in the absence of characteristic cut marks other explanations are equally plausible.

Unlike such evidence from Birka (Wigh 2001), the zooarchaeological evidence from Kaupang does not imply that the settlement was involved in the processing and trade of fur. However, this observation conflicts with what would be expected based on the 9th century account of Ohthere's trading expedition (Fell

1984). If both sources are combined in a general way (they differ slightly in date), it is possible that most furs entered Kaupang in an entirely pre-processed state and/or that they were re-exported rather than used to serve local needs.

The presence of processed furs at Kaupang is one way that the insect evidence could be explained. As noted in sections 14.3 and 14.4 above, fills of pit A43852, and to a lesser degree other deposits from the site, included unusually large numbers of *Omosita colon* beetles, together with a range of other species likely to have been attracted to dryish animal matter (including skins and bones): *Saprinus* sp., *Creophilus maxillosus, Trox scaber, Dermestes lardarius* adults and larvae, *Necrobia violacea, Necrobia* sp. indet. and *Tenebrio obscurus* (Tab. 14.9). The abundance of the genus *Omosita* in particular is exceptionally high in these deposits, in comparison with 3,069 comparative assemblages recorded at least semi-quantitatively that are known to one of the authors (Harry Kenward). This beetle was also described as "superabundant" in pit A28375 from the 2000 CRM excavation (Buckland et al. 2001). As discussed in section 14.4 above, the pit fills were probably composed at least in part of redeposited floor litter, so these finds may imply the storage of furs in buildings. Unfortunately, however, no animal hair itself was observed to corroborate this hypothesis. Another alternative is that these insects were simply attracted to dry bones in the deposits, but bones occur in pits at broadly comparable sites (e.g. Kenward and Hall 1995), and none of those pits exhibit the same abundance of *Omosita* beetles. Further possibilities are that the insects were attracted to dried fish or hides (rather than furs). Thus, in sum, due to the weakness of the ecofactual evidence, the possibility of fur trade at Kaupang remains a hypothesis rather than a conclusion.

Stockfish (dried cod and related species) were widely traded from Arctic and northwestern Norway in the Middle Ages (Nedkvitne 1976, 1993; Perdikaris 1999; Sørheim 2004). There are remains of stockfish in early post–Viking-age deposits from Trondheim (Hufthammer 2003) and evidence from areas of Norse settlement in Scotland imply that this commerce may have been active as early as the 11th century (Barrett 1997; Barrett et al. 1999, 2000). However, there is not yet convincing evidence that this trade existed on any scale earlier in the Viking Age (Barrett et al. 2004b). Most importantly, the elements present at Kaupang suggest that whole fish were consumed (Tab. 14.10). All parts of the skeletons of cod, saithe, ling and hake are represented; there is no *predominance* of cleithra, supracleithra and caudal vertebrae, which would be indicative of imported stockfish (Barrett 1997). The paucity of cleithra at Kaupang could be interpreted as indicating that stockfish were exported from the site, but is more likely to be a taphonomic pattern given the fragility of this element and the presence of some supracleithra (identifiable as cod family only and thus not shown in Table 14.10) and caudal vertebrae.

Herring from broadly contemporary settlements may occasionally represent cured trade goods, at inland Dorestad for example (Prummel 1983; Enghoff 1999), but they could derive from local fishing in most cases. The Kaupang assemblage is too small to detect whether the specialised butchery sometimes indicative of herring curing was employed (Enghoff 1996). Thus it is not possible to tell whether the herring were locally caught or imported as cured fish, but the former seems probable.

The status of domestic fowl ("chickens") in Viking-age Norway is slightly ambiguous due to the paucity of bone assemblages of this date from the region. However, hen bones were recovered from a possible Iron Age settlement at Viklem in Trøndelag (Hufthammer, pers. comm.). Moreover, a number of Viking-age and earlier records of domestic fowl are known from Sweden (Tyrberg 2002, pers. comm.), including the Viking-age trading settlement of Birka (Wigh 2001). Thus it is likely that they were locally available (Hufthammer, pers. comm.). Nevertheless, the slight possibility remains that they were introduced to Kaupang by long-range transport or trade, presumably from Denmark or Sweden. The other bird species from Kaupang could have been acquired locally, although one cannot rule out the possibility that some of the seabirds were cured and traded over considerable distances (cf. Serjeantson 2001).

Taxon	**n**
Saprinus sp.	1
Creophilus maxillosus	2
Omosita colon	97
Trox scaber	3
Dermestes lardarius adults	? 3
do. larvae	6
Necrobia violacea	1
Necrobia sp. indet.	1
Tenebrio obscurus	1 ? 1

Table 14.9 *Numbers of individuals (n) of beetles from pit A43852 which may have been attracted to stored skins.*

Table 14.10 *Element distribution of cod and herring (diagnostic elements only). See Barrett (1997) for definitions of vertebrae groups.*

Table 14.11 *Estimated total length of the main fish species from Kaupang based on a comparison of diagnostic elements with reference specimens of known size.*

Element	I	II	III	I-III	Disturbed	Total
Cod						
Abdominal Vertebra Group 1		9	3	1		13
Abdominal Vertebra Group 2		9	3	1	3	16
Abdominal Vertebra Group 3		11	7	2	1	21
Articular				1		1
Caudal Vertebra Group 1		13	8	1		22
Caudal Vertebra Group 2		6		1	2	9
Dentary		3		1	2	6
First Vertebra		1				1
Maxilla		4		1		5
Parasphenoid		1				1
Posttemporal		1				1
Premaxilla		8	2			10
Quadrate		2	2			4
Vomer		2	1			3
Atlantic Herring						
Abdominal Vertebra	1	30	78	6	4	119
Articular			1			1
Caudal Vertebra		26	85	4	3	118
First Vertebra		7	6	1		14
Opercular			1			1
Penultimate Vertebra			1			1
Quadrate			2			2
Ultimate Vertebra				1		1
Vertebra		3	3			6

Total Length	I	II	III	I-III	Disturbed	Total
Cod						
301-500mm		7	1	2		10
501-800mm		5	3	1	2	11
801-1000mm		4	1			5
>1000mm		3				3
Ling						
801-1000mm		5				5
>1000mm		1			2	3
Saithe						
501-800mm	1	1	2	1		5
801-1000mm		10	2		3	15
>1000mm		10		1	1	12
Hake						
501-800mm		2		2		4
801-1000mm		4		1	1	6
>1000mm		1				1

14.8 Regional dietary practices and "identity"

Dietary practices differed through space and time in northern Europe during the Viking Age. These differences were probably due to a combination of factors, ranging from local environmental conditions to emblematic expressions of identity (e.g. Barrett and Richards 2004; Schmölcke 2004). Within this mosaic of cultural food ways, Kaupang sits between "east" and "west".

If not just a product of unusual preservation and recovery conditions, the abundance of pigs at Kaupang is characteristic of proto-urban settlements in the Baltic region such as Birka, Hedeby and Groß Strömkendorf rather than comparable North Sea sites such as York and Hamwic (Southampton) (O' Connor 2004 and references therein; Schmölcke 2004). The abundance of herring also has echoes of Baltic dietary preferences (Enghoff 1999), although this species does occur in North Sea emporia as well (Barrett et al. 2004b).

In contrast, the trio of cod, saithe and ling (particularly of large sizes: Tab. 14.11), occasionally joined by hake or haddock, is very characteristic of Viking-age and later medieval assemblages from elsewhere in Norway (Lie 1988; Lindh 1991; Perdikaris 1999; Hufthammer 2000, 2003; Sørheim 2004) and from the North Atlantic region (Amorosi 1991; Barrett et al. 1999; Cerón-Carrasco 2005; Krivogorskaya et al. 2005). If not purely a matter of local availability, the dominance of these species in the fish-bone assemblage implies dietary choices with northwestern rather than eastern connections (cf. Schmölcke 2004).

Unfortunately, the bird-bone assemblage is too small to show meaningful patterns. With the exception of the slight possibility that domestic fowl were introduced from southern Scandinavia or eastern Sweden (as discussed in section 14.7 above), the species represented are not indicative of specific regional or cultural dietary practices.

14.9 Conclusions

Compared with the preservation at some Viking-age "towns", the preservation of ecofactual material at Kaupang was very limited. Nevertheless, analysis of what does survive has provided a wide range of evidence regarding the character and function of this important settlement. The site was probably occupied year-round, at least occasionally, but it also produced evidence of either periodic abandonment or a relatively short overall lifespan. Kaupang drew on a range of agricultural and forest resources from its local hinterland, implying that it either controlled or was controlled by a regional polity. The ecofactual evidence of long-range trade was very limited, but there is a slight possibility that skins (furs?) were stored indoors at the site prior to transhipment. Lastly, the subsistence practices at Kaupang implied associations with both the Baltic region to the east and the North Atlantic region to the west.

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Appendix 14.1

Complete list of plant taxa recorded from deposits at Kaupang. For vascular plants, nomenclature and taxonomic order follow Tutin et al. (1964–1980), for mosses Smith (1978). Preservation of plant material was by anoxic waterlogging except where noted. Plant taxa marked * were certainly or probably of recent origin in all cases where they were recorded. C – number of contexts, S – number of samples, in which remains were recorded (where both recent and ancient materials were recorded, only those contexts with ancient material are included in this count).

Taxon	Common name	Parts recorded	C	S
**cf. Selaginella selaginoides* (L.) Link	?lesser clubmoss	megaspores	-	-
Pteridium aquilinum (L.) Kuhn	bracken	stalk fragments	1	1
Juniperus communis L.	juniper	seeds	1	1
		leaves	2	2
		shoot fragments	1	3
cf. *J. communis*	?juniper	charred seeds	2	2
Coniferae	conifer	charcoal fragments	2	2
		leaf/leaves	1	1
		part-charred wood fragments	1	1
		twig fragments	1	1
		wood chips	4	5
		wood fragments	1	1
Salix sp(p).	willow	buds	2	2
	fruits		2	2
		leaf fragments	1	1
		twig epidermis fragments	1	1
		twig fragments	1	1
cf. *Salix* sp(p).	?willow	wood fragments	4	4
Salix/Populus sp(p).	willow/aspen	charcoal fragments	4	4
		wood fragments	1	1
Populus sp(p).	aspen	buds and/or bud-scales	5	7
Betula pendula Roth	silver birch	bark fragments	1+?1	1+?1
Betula sp(p).	birch	fruits	4	4
		buds and/or bud-scales	2	2
Alnus sp(p).	alder	charcoal fragments	1	1
		buds and/or bud-scales	1	3
		female cones/cone-axes	1	1
Alnus/Corylus	alder/hazel	charcoal fragments	2	2
Corylus avellana L.	hazel	buds and/or bud-scales	1+?1	1+?1
		charcoal fragments	3	3
		nuts and/or nutshell fragments	9	14
		charred nuts and/or nutshell fragments	18	22
		roundwood fragments	1	1
Quercus sp(p).	oak	buds and/or bud-scales	3	6
		charcoal fragments	11	15
		wood chips	1	1
		wood fragments	2	2
Humulus lupulus L.	hop	achenes	3	5
		bracts	1	1
Cannabis sativa L.	hemp	achenes	3	4
Urtica dioica L.	stinging nettle	achenes	8	11

Taxon	Common name	Parts recorded	C	S
U. urens L.	annual nettle	achenes	6	10
Polygonum aviculare agg.	knotgrass	fruits	5	8
P. hydropiper L.	water-pepper	fruits	3	4
		charred fruits	2	2
P. persicaria L.	persicaria/red shank	fruits	5	6
		charred fruits	4	4
P. lapathifolium L.	pale persicaria	fruits	4	5
		charred fruits	2	2
Polygonum sp(p).	knotweeds, etc.	fruits	1	1
Bilderdykia convolvulus (L.) Dumort.	black bindweed	fruits	1	1
		charred fruits	1	1
Rumex acetosella agg.	sheep's sorrel	fruits	3	3
Rumex sp(p).	docks	fruits	3	5
		charred fruits	1	1
		perianths/perianth segments	1	1
Chenopodium album L.	fat hen	seeds	9	14
		charred seeds	12	12
Atriplex sp(p).	oraches	seeds	7	12
		charred seeds	1	1
Chenopodiaceae	goosefoot family	charred seeds	3	3
Montia fontana ssp. *fontana* (Fenzl) Walters	blinks	seeds	1	1
*Caryophyllaceae	pink/campion family	seeds	-	-
Stellaria media (L.) Vill.	chickweed	seeds	5	7
		charred seeds	5	5
S. palustris Retz./*S. graminea* L.	marsh/lesser stitchwort	seeds	2	6
		charred seeds	1	1
Sagina sp(p).	pearlworts	seeds	1	1
Scleranthus annuus L.	annual knawel	fruits	2	2
Spergula arvensis L.	corn spurrey	seeds	1	1
		charred seeds	2	2
Agrostemma githago L.	corncockle	seeds	1	1
Silene vulgaris (Moench) Garcke	bladder campion	seeds	1	1
Silene sp(p).	campions, etc.	seeds	2	2
Ranunculus Section Ranunculus	meadow/creeping/bulbous buttercup	achenes	7	11
		charred achenes	1	1
R. cf. *sardous* Crantz	?hairy buttercup	charred achenes	1	1
R. sceleratus L.	celery-leaved crowfoot	achenes	8	12
R. flammula L.	lesser spearwort	achenes	3	5
		charred achenes	1	1
Fumaria sp(p).	fumitories	seeds	5	5
Descurainia sophia (L.) Webb ex Prantl	flixweed	seeds	1	1
Isatis tinctoria L.	woad	pod fragments	2	2
Rorippa palustris (L.) Besser	marsh yellow-cress	seeds	2	2
Rorippa sp(p).	yellow-cress	seeds	1	1
Capsella bursa-pastoris (L.) Medicus	shepherd's purse	seeds	1	1
Thlaspi arvense L.	field penny-cress	seed fragments	2	2
Raphanus raphanistrum L.	wild radish	pod segments and/or fragments	2	2
Filipendula ulmaria (L.) Maxim.	meadowsweet	achenes	3	4

Taxon	Common name	Parts recorded	C	S
Rubus idaeus L.	raspberry	seeds	9	9
R. fruticosus agg.	blackberry/bramble	seeds	8	13
		charred seeds	4	4
Rosa sp(p).	roses	achenes	2	2
		charred achenes	1	1
Potentilla palustris (L.) Scop.	marsh cinquefoil	achenes	2	2
P. anserina L.	silverweed	achenes	4	5
P. cf. *crantzii* (Crantz) Beck ex Fritsch	?alpine cinquefoil	achenes	1	1
P. cf. *erecta* (L.) Räuschel	?tormentil	achenes	6	11
		charred achenes	4	5
Potentilla sp(p).	cinquefoils, etc.	achenes	2	4
Fragaria cf. *vesca* L.	?wild strawberry	achenes	3	3
*cf. *Alchemilla* sp(p).	?lady's mantles	achenes	-	-
**Alchemilla/Aphanes* sp(p).	lady's-mantle/ parsley-piert	achenes	-	-
cf. Pomoideae	*?Crataegus/Malus/ Pyrus/Sorbus*	charcoal fragments	1	1
Malus sylvestris Miller	crab apple	endocarp	2	1
Sorbus aucuparia L.	rowan, mountain ash	seeds	1	1
Sorbus sp(p).	rowan/whitebeams	seeds	1	1
Trifolium pratense L.	red clover	calyx/calyces and/or pods	1	1
		pods and/or pod lids	1	1
Leguminosae	pea family	calyx/calyces or flowers	1	4
		flowers and/or petals	2	4
		immature seeds (waterlogged)	1	1
		pods and/or pod fragments	1	3
*Leguminosae	pea family	waterlogged seeds	-	-
Linum usitatissimum L.	cultivated flax	seeds	3	2
		capsule fragments	1	1
cf. *L. usitatissimum* L.	?cultivated flax	charred seeds	1	1
L. *catharticum* L.	purging flax	seeds	1	1
**Euphorbia helioscopia* L.	sun spurge	seeds	-	-
cf. *Acer* sp(p).	?maple, etc.	charcoal fragments	1	1
Malva sylvestris L.	common mallow	nutlets	2	2
Hypericum sp(p).	St John's worts	seeds	2	2
Viola sp(p).	violets/pansies, etc.	seeds	7	11
		charred seeds	1	1
		capsule segments	1	3
Heracleum sphondylium L.	hogweed	mericarps	1	1
Umbelliferae	carrot family	mericarps	1	1
Calluna vulgaris (L.) Hull	heather, ling	capsules	1	1
		flowers	1	1
Empetrum sp(p).	crowberry	seeds	1	1
Fraxinus excelsior L.	ash	charcoal fragments	12	12
Galium aparine L.	goosegrass, cleavers	charred fruits	6	6
Galium sp(p).	bedstraws, etc.	charred fruits	2	2
Galeopsis Subgenus *Ladanum*	hemp-nettles	charred nutlets	1	1
G. Subgenus *Galeopsis*	hemp-nettles	nutlets	2	5
Galeopsis sp(p).	hemp-nettles	nutlets	1	1
**Lamium* Section *Lamiopsis*	annual dead-nettles	nutlets	-	-
Lamium sp(p).	dead-nettles, etc.	nutlets	1	1
Stachys sp(p).	woundworts	nutlets	2+?1	2+?1

Taxon	Common name	Parts recorded	C	S
cf. *Glechoma hederacea* L.	ground-ivy	nutlets	1	1
Prunella vulgaris L.	selfheal	nutlets	2	4
Lycopus europaeus L.	gipsywort	nutlets	3	5
Labiatae	mint family	calyces	1	1
Hyoscyamus niger L.	henbane	seeds	1	2
Solanum nigrum L.	black nightshade	seeds	3+?1	4+?1
S. dulcamara L.	woody nightshade	seeds	1	1
Veronica sp(p).	speedwells, etc.	seeds	1	1
Rhinanthus sp(p).	yellow rattles	seeds	1	5
Plantago major L.	greater plantain	seeds	1	1
P. media L.	hoary plantain	charred seeds	1	1
P. lanceolata L.	ribwort plantain	seeds	1	1
Campanula rotundifolia L.	harebell, bluebell	seeds	2+?1	2+?2
Eupatorium cannabinum L.	hemp agrimony	achenes	1	1
Bidens sp(p).	bur-marigolds	achenes	2	3
Achillea millefolium L.	yarrow	capitulum fragments	1	1
**Matricaria maritima* L./	sea/scentless			
M. *perforata* Mérat	mayweed	achenes	-	-
Senecio sp(p).	groundsels/rag-			
	worts	achenes	1	1
Carduus/Cirsium sp(p).	thistles	achenes	6	8
Centaurea cf. *nigra* L.	?lesser knapweed	involucral bracts	1	1
Centaurea sp(p).	knapweeds, etc.	achenes	3	3
		immature achenes	1	1
		involucral bracts	1	1
Leontodon sp(p).	hawkbits	achenes	3	3
**Sonchus asper* (L.) Hill	prickly sow-thistle	achenes	-	-
**S. oleraceus* L.	sow-thistle	achenes	-	-
**Taraxacum* sp(p).	dandelions	achenes	-	-
Lapsana communis L.	nipplewort	achenes	3	3
Hieracium sp(p).	hawkweeds	achenes	1	2
Compositae	daisy family	achenes	1	1
		involucres/fragments	1	1
Triglochin maritima L.	sea arrowgrass	carpels	1	2
Juncus cf. *maritimus* Lam.	?sea rush	seeds	2	3
J. *inflexus* L./J. *effusus* L./	hard/soft/compact			
J. *conglomeratus* L.	rush	seeds	5	6
J. cf. *gerardi* Loisel.	?mud rush	seeds	3	3
J. *bufonius* L.	toad rush	seeds	10	15
Juncus sp(p).	rushes	seeds	3	5
Luzula sp(p).	woodrushes	seeds	2	5
Gramineae	grasses	waterlogged caryopses	3	7
		charred caryopses	4	4
		waterlogged culm bases/		
		rhizome fragments	1	1
		waterlogged spikelets/		
		spikelet fragments	1	1
Gramineae/Cerealia	grasses/cereals	waterlogged culm nodes	3	4
		waterlogged culm frag	1	4
Cerealia indet.	cereals	charred caryopses	1	1
		waterlogged culm frag.	1	1
cf. *Triticum* sp(p).	?wheats	charred caryopses	3	3
Triticum/Hordeum sp(p).	wheat and/or barley	charred caryopses	1	1
Secale cereale L.	rye	charred caryopses	3+?4	3+?4

Taxon	Common name	Parts recorded	C	S
Hordeum sp(p).	barley	charred caryopses (inc. some hulled specimens)	41	45
Avena sp(p).	oats	charred caryopses	2	2
Agrostis sp(p).	bent grasses, etc.	waterlogged caryopses	1	1
Danthonia decumbens (L.) DC. in Lam. & DC.	heath grass	caryopses	2	5
		waterlogged spikelets/ spikelet fragments	2	4
		waterlogged chaff	1	2
Scirpus cf. *maritimus* L.	?sea club-rush	nutlets	4	7
S. *lacustris* sensu lato	bulrush	nutlets	1+?2	1+?2
		charred nutlets	1	1
Eleocharis palustris sensu lato	common spike-rush	nutlets	7	12
		charred nutlets	2	2
cf. *Eleocharis* sp(p).	?spike-rushes	nutlets	1	1
Carex sp(p).	sedges	nutlets	9	14
		charred nutlets	30	33
Musci (remains were leaves and/or shoot fragments unless otherwise indicated)				
Sphagnum squarrosum Crome			1	2
Sphagnum sp(p).		leaves	3	3
		leaves and shoot tips	3	3
		leaves and shoot fragments	1	1
Polytrichum commune Hedw.			1	2
Polytrichum commune var. *commune* Hedw.			1	1
Polytrichum/Pogonatum sp(p).		leaf-bases	2	2
		shoot fragments	1	1
Polytrichum sp(p).		leaves/leaf-bases and/ or shoot fragments	2	4
		shoot fragments	1	4
Dicranum scoparium Hedw.			1	1
Dicranum sp(p).			1	3
Leucobryum glaucum (Hedw.) Ångstr.			1	1
Racomitrium sp(p).			2	4
Plagiomnium undulatum (Hedw.) Kop.			1+?1	1+?1
cf. *Plagiomnium* sp(p).			1	1
Pseudobruym cinclidioides (Hüb.) Kop.			1	1
Aulacomnium palustre (Hedw.) Schwaegr.			1	2
Climacium dendroides (Hedw.) Web. & Mohr			1	2
Leucodon sciuroides (Hedw.) Schwaegr.			2	2
Antitrichia curtipendula (Hedw.) Brid.			1	1
Thamnobryum alopecurum (Hedw.) Nieuwl.			1	1
Thuidium tamariscinum (Hedw.) Br. Eur.			1+?1	2+?3
cf. *Cratoneuron commutatum* (Hedw.) Roth			1	1
Calliergon cuspidatum (Hedw.) Kindb.			1	3
Isothecium myosuroides Brid.			1	1
Homalothecium sericeum (Hedw.) Br. Eur. / *H. lutescens* (Hedw.) Robins.			1	1
Hypnum cf. *cupressiforme* Hedw.			1	1
Rhytidiadelphus cf. *squarrosus* (Hedw.) Warnst.			1	3
Rhytidiadelphus sp(p).			1	1
Pleurozium schreberi (Brid.) Mitt.			1	2
Hylocomium splendens (Hedw.) Br. Eur.			5	7

Appendix 14.2

'Useful' plant taxa recorded from deposits at Kaupang, with their Norwegian vernacular names (courtesy of Den virtuella Floran, http://linnaeus.nrm.se/flora).

Taxon	Parts used	Norwegian name	English name
Pteridium aquilinum	Fronds	Einstape	Bracken
Juniperus communis	Shoots, Berries	Einer	Juniper
Salix	Wood, Twigs	Vier	Willow
Populus	Wood	Osp	Poplar/aspen
Betula	Wood, Bark	Bjørk	Birch
Alnus	Wood	Svartor	Alder
Corylus avellana	Wood, Nuts	Hassel	Hazel
Quercus	Wood, Acorns	Eik	Oak
Humulus lupulus	Fruits	Humle	Hop
Cannabis sativa	Fruits	Hamp	Hemp
Isatis tinctoria	Leaves	Waid	Woad
Rubus idaeus	Fruits	Bringbær	Raspberry
Rubus fruticosus agg.	Fruits	Bjønnbær	Blackberry
Rosa	Fruits	Nype	Rose
Fragaria cf. *vesca*	Fruits	Markjordbær	Strawberry
Malus sylvestris	Fruits	Villapal	Wild Apple
Sorbus aucuparia	Fruits	Rogn	Rowan
Linum usitatissimum	Seeds, Stem Fibres	Lin	Flax, Linseed
Empetrum	Fruit	Krekling	Crowberry
Calluna vulgaris	Whole Plant	Røsslyng	Heather, Ling
Fraxinus excelsior	Wood	Ask	Ash
Secale cereale	Grains, Straw	Rug	Rye
Hordeum	Grains, Straw	Bygg	Barley
Avena	Grains, Straw	Havre	Oats

Appendix 14.3

Complete list of invertebrate remains recorded from samples from the Kaupang site. Order and nomenclature follow Kloet and Hincks (1964–1977) for insects. Where both secure and tentative identifications of a given taxon were recorded, only the former is listed here. The remains were of adults unless stated. 'sp.' indicates that record was probably an additional taxon, 'sp. indet.' that the material may have been of a taxon listed above it.

Coelenterata
*Coelenterata sp. (hydroid stem or theca)

Nematoda
**?Heterodera* sp. (cyst)

Annelida: Oligochaeta
*Oligochaeta sp. (egg capsule)

Crustacea
**Daphnia* sp. (ephippium)
*Cladocera sp. (ephippium)

Insecta
Hemiptera
Lygaeidae sp.
Cimicidae sp.
Corixidae sp.
Philaenus spumarius (Linnaeus)
Cicadellidae sp.
?Euconomelus lepidus (Boheman)
Delphacidae sp.
*Auchenorhyncha sp. (nymph)
*Psylloidea sp. (nymph)
*Aphidoidea sp.

Diptera
*Chironomidae sp. (larva)
*Diptera sp. (adult)
*Diptera sp. (pupa)
*Diptera sp. (puparium)

Siphonaptera
**Pulex irritans* Linnaeus
*Siphonaptera sp.

Trichoptera
*Trichoptera sp.

Coleoptera
Dyschirius globosus (Herbst)
Clivina fossor (Linnaeus)
Patrobus ?atrorufus (Strom)
Patrobus sp. indet.
Trechus ?micros (Herbst)
?Trechus sp.
Pterostichus melanarius (Illiger)
Pterostichus ?nigrita (Paykull)
Pterostichus (Poecilus) sp.
Pterostichus spp.
Calathus sp.
Amara sp.
Dromius quadrimaculatus (Linnaeus)
Dromius quadrinotatus (Zenker)
Metabletus sp.
Carabidae spp. and spp. indet.
Helophorus spp.
Cercyon analis (Paykull)
Cercyon atricapillus (Marsham)
Cercyon haemorrhoidalis (Fabricius)
Cercyon quisquilius (Linnaeus)
Cercyon ?tristis (Illiger)
Cercyon spp. indet.
Cryptopleurum minutum (Fabricius)
?Hydrobius fuscipes (Linnaeus)
Chaetarthria seminulum (Herbst)
Hydrophilinae sp.
Acritus nigricornis (Hoffmann)
Saprinus sp.
Histerinae sp.
Ochthebius sp.
Ptenidium spp.
Acrotrichis sp.
Ptiliidae sp.
Catops sp.
Micropeplus porcatus (Paykull)
Micropeplus tesserula Curtis
Megarthrus sp.
Acidota cruentata Mannerheim
Phyllodrepoidea crenata (Gravenhorst)
Eusphalerum ?minutum (Fabricius)
Phyllodrepa ?floralis (Paykull)
Omalium ? italicum Bernhauer
Omalium caesum or italicum
Omalium ?rivulare (Paykull)
Omalium sp. indet.
Xylodromus concinnus (Marsham)
Omaliinae spp.
Carpelimus bilineatus Stephens
Carpelimus elongatulus (Erichson)
Carpelimus sp.
Platystethus arenarius (Fourcroy)
Platystethus nodifrons (Mannerheim)
Anotylus nitidulus (Gravenhorst)
Anotylus rugosus (Fabricius)
Oxytelus sculptus Gravenhorst

Stenus spp.
Lathrobium sp.
?Rugilus sp.
Leptacinus ?intermedius Donisthorpe
Leptacinus sp.
Gyrohypnus angustatus Stephens
Gyrohypnus fracticornis (Müller)
Gyrohypnus sp. indet.
Xantholinus sp.
Neobisnius sp.
Philonthus spp.
Creophilus maxillosus (Linnaeus)
?Ontholestes sp.
Quedius spp.
Staphylininae spp. indet.
Tachyporus sp.
Tachinus sp.
Cypha sp.
Cordalia obscura (Gravenhorst)
Falagria caesa or *sulcatula*
Crataraea suturalis (Mannerheim)
Aleochara sp.
Aleocharinae spp.
Euplectini sp.
Pselaphidae sp.
Trox scaber (Linnaeus)
Geotrupes sp.
Aphodius ?fimetarius (Linnaeus)
Aphodius granarius (Linnaeus)
Aphodius ?rufipes (Linnaeus)
Aphodius ?sphacelatus (Panzer)
Aphodius spp. and spp. indet.
Clambus sp.
**Melanotus erythropus* (Gmelin) (larva)
Dermestes ?lardarius Linnaeus
**Dermestes lardarius* (larva)
?Dermestes sp. indet.
Anobium sp.
Ptinus fur (Linnaeus)
Ptinus raptor Sturm
Ptinus sp. and spp. indet.
Lyctus linearis (Goeze)
Necrobia violacea (Linnaeus)
Necrobia sp. indet.
Malachius sp.
Brachypterus sp.
?Meligethes sp.
Omosita colon (Linnaeus)
Glischrochilus quadripunctatus (Linnaeus)
Monotoma longicollis (Gyllenhall)
Cryptophagus ?scutellatus Newman
Cryptophagus spp.
Atomaria spp.
Ephistemus globulus (Paykull)
Orthoperus spp.
Coccidula ?scutellata (Herbst)
?Scymnus sp. s. lat.
Coccinellidae sp.
Lathridius minutus group
Enicmus sp.
Corticaria spp.
Corticarina sp.
Corticarina or *Cortinicara* sp. indet.
Cisidae sp.
Aglenus brunneus (Gyllenhal)
Tenebrio obscurus Fabricius
Rhinosimus planirostris (Fabricius)
Anthicus sp.
Chrysomelinae sp.
Galerucella sp.
Longitarsus sp.
Crepidodera sp.
Chaetocnema arida group
Chaetocnema concinna (Marsham)
Chaetocnema sp. indet.
Cassida sp.
Apion spp.
Sitona sp.
Notaris acridulus (Linnaeus)
Cidnorhinus quadrimaculatus (Linnaeus)
Ceuthorhynchinae sp.
Curculionidae spp. and spp. indet.
Scolytus ?intricatus (Ratzeburg)
Leperisinus varius (Fabricius)
Scolytidae sp.
Coleoptera spp. and spp. indet.
*Coleoptera spp. (larva)

Hymenoptera
*Chalcidoidea spp.
*Proctotrupoidea spp.
*Hymenoptera Parasitica spp.
**Apis mellifera* Linnaeus
*Apoidea sp. indet.
*Formicidae spp.
*Hymenoptera spp.

*Insecta sp. (larva)

Arachnida
*Pseudoscorpiones sp.
*Aranae spp.
*Acarina spp.

Appendix 14.4

English, Latin and Norwegian names of birds, fish and mammals identified at Kaupang. Nomenclature follows Harland et al. (2003) and references therein.

	Common name	Latin name	Norwegian name
Bird	Brent Goose	*Branta bernicla*	Ringgås
	Barnacle Goose	*Branta leucopsis*	Hvitkinngås
	Eider	*Somateria mollissima*	Ærfugl
	Shelduck	*Tadorna tadorna*	Gravand
	Swan, Goose & Duck Family	Anatidae	Andefamilien
	Domestic Fowl ('Chicken')	*Gallus gallus*	Høne
	Great Black-backed Gull	*Larus marinus*	Svartbak
	Little Auk	*Alle alle*	Alkekonge
Fish	Shark, Skate & Ray Orders	Pleurotremata/Hypotremata	Hai/Skate/Rokke
	Dogfish Families	Scyliorhinidae/Squalidae	Rødhai/Håfamilien
	Eel	*Anguilla anguilla*	Ål
	Atlantic Herring	*Clupea harengus*	Sild
	Salmon & Trout Family	Salmonidae	Laksefamilien
	Trout?	cf. *Salmo trutta*	Ørret
	Cod Family	Gadidae	Torskefamilien
	Cod	*Gadus morhua*	Torsk
	Ling	*Molva molva*	Lange
	Pollack	*Pollachius pollachius*	Lyr
	Saithe	*Pollachius virens*	Sei
	Hake	*Merluccius merluccius*	Lysing
	Gurnard Family	Triglidae	Knurrfamilien
	Wrasse Family	Labridae	Leppefiskfamilien
	?Halibut	cf. *Hippoglossus hippoglossus*	?Kveite
Mammal	Shrew Species	*Sorex*	Spissmus
	Dog Family	Canidae	?Hund
	Cat	*Felis catus*	Katt
	Horse	*Equus caballus*	Hest
	Pig	*Sus domesticus*	Gris
	Deer	Cervidae	Hjortedyr
	Red Deer	*Cervus elaphus*	Hjort
	Cattle	*Bos taurus*	Storfe
	Sheep	*Ovis aries*	Sau
	Sheep/Goat	*Ovis aries* or *Capra hircus*	Småfe, Sau/Geit
	Hare	*Lepus*	Hare